2007

Evaluating the Psychosocial Effects of Two Interventions, Tai Chi and Spiritual Growth Groups, in Women with Breast Cancer

Sarah M. Rausch
Virginia Commonwealth University

Evaluating the Psychosocial Effects of Two Interventions, Tai Chi and Spiritual Growth Groups, in Women with Breast Cancer

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

By

Sarah Michelle Rausch
Master of Science
Virginia Commonwealth University
2007

Co-Directors:

Stephen Auerbach, Ph.D.
Professor, Department of Psychology
College of Humanities and Sciences

Sandra Gramling, Ph.D.
Associate Professor, Department of Psychology
College of Humanities and Sciences

Virginia Commonwealth University
Richmond, Virginia
July, 2007

Acknowledgement

This work is dedicated to Joyce Peggs, my inspiration, who showed how to live life to its fullest while undergoing treatment for and dying from breast cancer.

Throughout the duration of this project, we have unfortunately suffered through many losses, most to cancer. Therefore, acknowledgement is also given to those who shared their lives and filled ours:

Richard J. Rausch
1947-2003

Joyce Peggs
1960-2007

Thomas Curran
1913 - 2007

Elizabeth Fries
1963-2005

Donald Kiesler
1933-2007

and

Tim Hodges

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Abbreviations

CAM	Complementary and Alternative Medicine
CESD	Center for Epidemiological Study of Depression
CTRL	Control
EI	Emotional Intelligence
GCRC	General Clinical Research Center
HPV	Human Pappiloma Virus
IES	Impact of Events Scale
IL	Interleukin
IFN	Interferon
LOT	Life Orientation Test
MBSS	Miller Behavioral Style Scale
MCC	Massey Cancer Center
NCCAM	National Center for Complementary and Alternative Medicine
NCI	National Cancer Institute
NIH	National Institute of Health
POMS	Profile of Mood States
PNI	Psychoneuroimmunology
QOL	Quality of Life
SAS	Smith Anxiety Scale
SG	Spiritual Growth
T1	Time 1
T2	Time 2
TCH	Tai Chi
TMMS	Trait Meta Mood Scale
TNF	Tumor Necrosis Factor
VCU	Virginia Commonwealth University
VCUHS	Virginia Commonwealth University Health System

ABSTRACT

EVALUATING THE PSYCHOSOCIAL EFFECTS OF TWO INTERVENTIONS, TAI CHI AND SPIRITUAL GROWTH GROUPS, IN WOMEN WITH BREAST CANCER

By Sarah M. Rausch, M.S.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

Virginia Commonwealth University, 2007

Major Directors: Stephen Auerbach, Ph.D., Professor
Department of Psychology
College of Humanities and Sciences

Sandy Gramling, Ph.D., Associate Professor
Department of Psychology
College of Humanities and Sciences

One in seven women will develop breast cancer. Most will suffer medically and psychologically from the disease. Complementary and alternative medicine (CAM) interventions such as tai chi and spiritual growth groups have proven to be beneficial for this population, however, many questions remain regarding the mechanisms of action in these techniques. The purpose of this study was to evaluate the psychosocial effects and mechanisms of two 10-week interventions (tai chi and spiritual growth groups) within the context of a larger randomized, controlled NCI-funded study (R01 CA114718, Nancy

McCain, PI) in women recently diagnosed with breast cancer. The present study evaluated dispositional predictors (optimism, attentional style, emotional intelligence) as well as the effects of these interventions on measures of mood, coping, and quality of life (QOL) in a subsample of 40 women enrolled in the larger study. Participants were primarily Caucasian (73%) with a mean age of 49 years. Data were collected just prior to beginning chemotherapy when the interventions began, and again 10 weeks later. Twenty-nine participants completed the interventions and had both time 1 and time 2 data. There were 15 women in the tai chi group, 6 in the spiritual growth group, and 8 in the control group. Results from this subsample revealed differential effects of the interventions on total mood disturbance, depressive symptoms and QOL. Optimism was a significant predictor of TNF-α levels, monitoring was a significant predictor of changes in anxiety and QOL, and emotional intelligence was a significant predictor of changes in QOL. These findings give promise to future studies aimed at cross-validating with a larger sample. This research could potentially guide the treatment of women with breast cancer by providing enhanced understanding of how tai chi and spiritual growth groups affect this population psychologically, behaviorally, and biologically.

.

CHAPTER 1

Introduction and Background

Coping with the disability, symptoms, and uncertainties of chronic or life-threatening disease and its treatment is extremely challenging. Breast cancer is a particularly distressing medical diagnosis, and one in seven women will receive a breast cancer diagnosis (ACS, 2004). Over 200,000 women are diagnosed with breast cancer each year (ACS, 2004). These women face many negative psychological consequences. (Shapiro et al., 2001). These consequences reduce overall well-being, and may limit patients' active participation in the healing process. Helping chronically ill individuals adjust to their disease taxes the resources and often exceeds the limits of conventional medicine (Grossman, 2004). Thus, a brief and cost-effective program that reduces the negative psychological consequences associated with a breast cancer diagnosis would be valuable. Accordingly, there is growing attention to the health benefits of mind-body-spirit interventions (Tacon, 2003) that can be categorized as "complementary and alternative medicine (CAM)." CAM includes the stress management interventions in the proposed research, tai chi and spiritual growth groups.

CAM Interventions

CAM's mind-body-spirit interventions, including strategies for stress management, may mitigate psychological distress, improve coping skills, and enhance immune function through neuroendocrine-immune system modulation (Andersen, 2002; Glaser & Kiecolt-Glaser, 1994; Turner-Cobb et al., 2001). Thus, CAM interventions may attenuate psychological and physical symptoms, thereby improving quality of life (QOL) for persons with cancer, including those undergoing surgery, chemotherapy, or radiation

therapy. Not surprisingly, as many as 80% of cancer patients report using CAM (Bernstein & Grasso, 2004). A comprehensive review of psychosocial interventions for cancer patients concluded that multimodal interventions along with "assessment of psychological, behavioral, and biological mechanisms are the pathways for future research" (Andersen, 2002; p. 590). This study therefore sought to investigate precisely this issue: the psychosocial effects of two multimodal CAM interventions, tai chi and spiritual growth groups, in the context of an existing PNI-based clinical trial (R01 CA114718; McCain, PI). Investigating the psychosocial mechanisms was a unique addition which was undertaken to provide insight and understanding of these CAM interventions while taking best advantage of an existing sample in an NIH/NCI-funded clinical trial.

Tai Chi

Tai chi (TCH) is a fitness exercise originally developed by Taoist monks to reflect the importance of the balance of persons with nature. The primary principles of TCH are holism and connectedness. The practice emphasizes not only harmony with nature but within oneself, balancing the physical, mental, and spiritual aspects of life. TCH is referred to as a "moving meditation" that focuses on the connection of mind and body to facilitate healing through breathing, relaxation, and movement (Wanning, 1993). The current practice of TCH has evolved into a series of relaxed, smooth, and graceful movements (Wolf, Coogler, & Xu, 1997).

Many studies have reported that TCH produces numerous beneficial effects in various populations (e.g., Bottomley, 2000; Taylor, 2003). There is growing empirical support for the notion that TCH may influence physical as well as psychological states

(Kleine & Adams, 2004). In recent reviews, controlled research evidence has been found to confirm therapeutic benefits of TCH practice with regard to: quality of life (Kleine & Adams, 2004), physical function (Kleine & Adams, 2004; Young et al., 1999), respiratory function (Li et al., 2001;Wang et al., 2004) cardiovascular function (Chen & Snyder, 1999; Li et al., 2001; Wang et al., 2004), pain management (Adler et al., 2000; Bhatti et al., 1998), balance and risk of falls reduction (Chen & Snyder, 1999;), muscle strength (Li et al., 2001), enhancing immune response (Irwin et al., 2003; Li et al., 2001; Xusheng et al., 1990), arthritis (Hartman et al., 2000; Wang et al., 2004), psychosocial domains (Bhatti, 1998; Chen & Snyder, 1999; Hartman et al., 2000; Li et al., 2001; Sandlund & Norlander, 2000; Wang et al., 2004) and flexibility, strength, and kinesthetic sense (Kleine & Adams, 2004). However, to date, we have not seen any articles evaluating the effects of TCH in women newly diagnosed with breast cancer. Two studies (Mustian et al., 2004, 2006) have evaluated TCH in survivors of breast cancer. In both of these studies, a 12-week intervention was compared to psychosocial support, and they found TCH to be more effective in health-related QOL, self-esteem, and functional capacity (aerobic capacity, muscle strength, flexibility).

Spiritual Growth

Spiritual growth (SG) groups emphasize personal exploration and communal sharing of spirituality. Spirituality is a critical component of holistic treatment. Only recently has traditional medicine embraced spirituality, and studies have begun to document it as a contributor to positive health outcomes (Kass et al., 1991; Levin, 1994). The central role of spirituality in chronic illness has been examined in several studies (Targ & Levine, 2002).

Several studies have demonstrated that the spiritual dimension is important in the attainment of an overall sense of health, well-being, and QOL (e.g., Cohen et al., 2001; Nelson et al., 2002; Post-White et al., 1996). In one study of persons with HIV infection, there was a direct relationship between spirituality and QOL, social support, and effective coping strategies, and an inverse relationship between spirituality and perceived stress (Tuck et al., 2001). In one of the few studies with PNI-related outcomes, a group of hospice patients who rated spiritual expression as important had greater numbers of circulating white blood cells and total lymphocytes than those who did not (Sephton et al., 2001).

Although there is considerable literature related to spirituality and breast cancer, the vast majority of studies to date have been descriptive or exploratory (Andersen, 2002). In one of the few intervention studies, the effects of a standard support group or a CAM intervention were examined in a clinical trial with 181 women with breast cancer (Targ & Levine, 2002). The CAM intervention was based on psychospiritual approaches, including meditation, affirmation, imagery, and rituals. Women in both groups showed improved QOL and spiritual well-being, and decreased depression and anxiety. However, only the CAM group showed increased spiritual integration and satisfaction, and less attrition. Clearly, more intervention research is needed to understand the mechanisms of mind-body-spirit interventions for various populations.

Summary

In developing the methodology for the larger study in which the present investigation is embedded, TCH and SG were selected as the interventions to be evaluated based on a sound research- and theory-driven framework. These approaches

were chosen because (a) they are minimally "physical" and thus not likely to cause or enhance fatigue, (b) they can be learned within a brief time period and used without further instruction or supervision over time and (c) the co-investigators of the larger study had extensive expertise and training in these strategies.

CAM and Psychoneuroimmunology

When CAM interventions are effective as adjunct therapies for cancer patients, they likely influence psychosocial, behavioral, and biological mechanisms. Psychoneuroimmunology (PNI) is concerned with the mechanisms of multidimensional psychobehavioral-neuroendocrine-immune system interactions, including the influence of psychosocial, spiritual, and behavioral factors on immunologically moderated diseases such as cancer. Various psychological states and emotions (e.g. grief, depressed mood, perceived loss of control) suppress immune function reliably (Folkman, 1993; Kiecolt-Glaser & Glaser, 2002a; Smith, 1993). Chronic stress and the associated psychological distress can activate the hypothalamic-pituitary-adrenocortical and sympathetic-adrenomedullary systems, thereby increasing cortisol and inducing immunosuppression. Cortisol inhibits virtually all components of the immune response (Dhabar & McEwen, 2001; Kiecolt-Glaser et al., 2002a). Thus, chronic or severe psychological stress associated with a diagnosis of cancer and immunosuppressive treatments may further compromise immune functioning, thereby increasing risks for morbidity and mortality, as well as decreasing overall QOL.

There is compelling evidence for neuroendocrine and behavioral interactions, especially stress effects, with the immune system (Kiecolt-Glaser et al., 2002a, 2002b). However, the influence of those interactions on health outcomes is only beginning to be

examined (Andersen, 2002; Biondi, 2001). PNI accounts for the negative impact of perceived stress on health outcomes, primarily as a function of immunosuppression mediated by elevated cortisol. However, the underlying mechanisms for downregulation and enhancement of immune function are neither simple nor clear. Therefore, the current study investigated the psychosocial mechanisms of action in the context of a CAM intervention study with PNI-based outcomes in breast cancer patients. This project provides added value to the larger study by providing a thorough evaluation of the dispositional and situational variables, as well as potential mediators that may account for changes in outcomes.

Psychosocial Mechanisms of Action

In the context of interventions, psychosocial mechanisms of action refer to how the intervention works, specifically, who will benefit from the intervention, active components of the intervention, and variables that interact with or mediate the intervention and outcomes (Christensen, 1996). In order to evaluate these mechanisms, dispositional (e.g., optimism, emotional intelligence, attentional style) and state (e.g., mood, coping, QOL, perceived stress) variables must be evaluated in relation to each other and to additional outcomes.

There are only a few relaxation studies to date involving breast cancer patients, and they consistently have shown that the interventions elicit beneficial outcomes (e.g., increased QOL, reduced psychological morbidity, increased immune function) (Andersen, 2002). However, little is known about the psychosocial mechanisms of action in these interventions. Expert panels convened by the National Center for Complementary and Alternative Medicine (NCCAM) and members of the National

Advisory Council concluded in 2002 that "the research portfolio would be better served by an increased emphasis on studies of the mechanisms underlying CAM approaches, and by more thorough examination of the interventions themselves, as critical preparation for, and to better ensure the success of, more substantive phase II and III trials." Furthermore, NCCAM also concluded that "elucidating the underlying mechanisms of action of CAM therapies will further facilitate the acceptance into mainstream medicine of CAM therapies that are proven safe and effective (NCCAM, 2004)." Therefore, in-line with the published priorities of NCCAM, the current study investigated the psychosocial mechanisms of two CAM interventions, with PNI outcomes. In order to do so, dispositional and situational variables were evaluated.

Dispositional Variables in Intervention Research

Dispositional variables reveal whether stable person-characteristics account for change, or lack of change, in treatment outcomes. Further, in the context of an intervention, dispositional variables reveal which intervention works for whom, one important aspect of evaluating psychosocial mechanisms of action. According to Carver and Scheier (1994) "much of the breast cancer literature focuses on social support, but few studies have dealt with personality" (p. 185). Kiecolt-Glaser (2002) added, "aspects of personality or [stable] coping styles associated with negative moods or social relationships might demonstrate immunological correlates under certain circumstances" (p.165). For instance, the dispositional variables of interest to the present study, optimism, attentional style, and emotional intelligence (which were added to the larger study), have been linked with differential effects on numerous outcomes (Carver et al., 1993; Carver & Scheier, 1994, Miller et al., 1988; Miller et al., 2001; Schmidt &

Andrykowski, 2004). Optimism, attentional style, and emotional intelligence are reviewed briefly below.

Optimism

Optimism has consistently been associated with beneficial physiological and psychological outcomes in numerous populations, including persons with breast cancer (e.g., Ah, Kang, & Carpenter, 2007; Carver et al., 1993; Epping-Jordan et al., 1999; Stanton & Snider, 1993). In women with breast cancer, higher levels of optimism have consistently been associated with lower levels of psychological distress. For instance, in a study of 59 women with breast cancer (Carver et al., 1993), optimism was predictive of lower distress (computed total of anxiety, depression and anger subscales of the Profile of Mood States) post-surgery, and at 3-, 6- and 12-month follow-ups. In another study of 80 women newly diagnosed with breast cancer (Epping-Jordan et al., 1999), authors reported that higher levels of optimism were significantly associated with lower levels of anxiety, depression, and intrusive thoughts. In two studies by Carver, Lehman, and Antoni (2003), women with breast cancer reported significant relationships between optimism and distress. In both studies reported (Study 1, $n = 235$; Study 2, $n = 97$), high levels of optimism significantly predicted lower levels of anxiety and depression.

Optimism has also been associated with positive health outcomes in a number of studies. For instance, higher levels of optimism have been associated with lower blood pressure during daily life (Raikkonen, et al., 1999) and better recovery from coronary artery bypass surgery (Scheier et al., 1999). In healthy subjects, researchers have found optimism to be associated with higher immune parameters, including higher T-lymphocyte numbers and natural killer cell activity (Cohen et al., 1999; Segerstrom,

Taylor, Kemeny, & Fahey, 1998). In a population of black women co-infected with human immunodeficiency virus and human papillomavirus (HPV), Byrnes et al. (1998) found more optimistic women had better immunity. Specifically, greater optimism was related to higher natural killer cell cytotoxicity and cytotoxic/suppressor cell numbers after controlling for presence/absence of HPV, behavioral/lifestyle factors, and subjective impact of negative life events. These positive effects on physical health mirror optimism's consistently reported beneficial effects on mental health. Although the relationship between optimism and immune parameters in women with breast cancer is still somewhat unclear, optimism has consistently been linked to improved physiological outcomes. Furthermore, differences in mood and coping have been shown to mediate optimists' better immune function (Kiecolt-Glaser et al., 2002a). Therefore, it was hypothesized that higher levels of optimism would predict greater improvements in immune function as measured by Type I and II cytokine levels, and that coping would mediate the relationship between optimism and improved immune function.

Attentional Style

Two attentional coping styles have been found to account for variations in the effect of information on affective state: namely "monitoring" or those who attend to threatening information, and "blunting" or those who avoid threatening information (Miller, 1987). Monitoring and blunting have been studied in a number of healthcare situations (Miller et al., 2001). In patients with cancer, monitors are generally more concerned and distressed about their cancer risk, experience greater treatment side effects, and are more knowledgeable about their medical conditions. Monitors also manifest greater psychological morbidity in response to cancer-related threats (Miller et

al., 2001). For instance, in an educational intervention study for 239 women, monitors increased their distress levels from baseline to follow-up (Miller et al., 2001). In another study evaluating chemotherapy side effects, Gard (1988) found that a significantly higher percentage of monitors experienced nausea compared with the blunters (75% vs 41%), and reported that it lasted longer (16 hrs vs 4.5 hrs). These results were obtained despite the finding that significantly more monitors obtained antiemetic medication to reduce the severity of these side effects (45% vs 87%). However, the two groups did not differ on any other demographic or health variables.

In general, patients fare better (psychologically, behaviorally, and physiologically) when the information they receive about their medical condition is tailored to their own attentional coping styles. Those with a monitoring style tend to do better when given more information, and those with a blunting style do better with less information (Miller, 1988). For instance, when evaluating distress levels in 239 women undergoing breast cancer risk counseling, Lerman et al (1996) found that women who were categorized as monitors reported less distress when they were provided with more information. Similarly, Miller and Mangan (1983) randomized 40 gynecologic patients about to undergo a diagnostic procedure to either a voluminous prepatory information or low information intervention. Overall, they found blunters reported less subjective and behavioral arousal than monitors. Additionally, they found that when the intervention was matched to attentional style (monitors receiving voluminous information, blunters receiving little information) participants reported significantly lower levels of distress.

Therefore, because the interventions in the current study do not involve any health-specific information, it was hypothesized that those with a blunting orientation would show greater reductions in anxiety. Although mediational relationships have not been evaluated with monitors and blunters, it was also hypothesized that anxiety would mediate the relationship between attentional style (specifically blunters in these intervention groups) and QOL.

Emotional Intelligence

Emotional intelligence (EI) is a dispositional characteristic defined as "the ability to understand, accurately perceive, express, and regulate emotions" (Mayer & Salovey, 1997, p. 3). Recent work addressing emotional expression and adjustment to cancer suggests that coping through actively processing and expressing emotion leads to better long-term psychological adjustment (Stanton et al., 2000). Thus, EI may play an important role in the process of psychological adaptation in the breast cancer experience.

Although research on EI in breast cancer is extremely limited, a recent study evaluated the role of EI and social support in 210 breast cancer patients (Schmidt & Andrykowski, 2004). Specifically, they evaluated psychological adjustment as a function of emotional intelligence in participants recruited via postings to Internet-based breast cancer support groups. They found that lower levels of EI and high social constraints were associated with greater distress, as measured by depression, anxiety, and perceived stress. Additionally, high EI buffered against the negative impact of other stressors. Thus, for the current study, it was hypothesized that higher levels of EI would predict greater outcome improvements in perceived stress levels, and perceived stress would mediate the relationship between EI and QOL.

State Variables

The state variables in the present study included mood, coping, QOL, and perceived stress. These variables were evaluated as potential mediators and as outcomes. Although variables such as coping, anxiety, and perceived stress were once thought of as trait measures, a considerable amount of research has shown that coping, anxiety, and perceived stress change with time and different situations (Andersen, 2002; Carver & Scheier, 1994; Carver et al., 1993; Schmidt & Andrykowski, 2004), and are therefore now known as state measures. Coping, perceived stress, and QOL are included in the larger study. Measures of mood were added to the current study.

Mood

Most stress management, relaxation, and CAM interventions studies for cancer patients have reported significant post-intervention reductions in mood disturbance, generally as measured by the Profile of Mood States (POMS; see review in Andersen, 2002). For example, in a randomized, controlled study with 154 women with breast cancer, six-weeks of relaxation and imagery produced improvements in the total mood disturbance score of the POMS (Bridge et al., 1988). In another randomized, controlled study, a seven-week mindfulness-based stress reduction intervention resulted in reductions on all subscales of the POMS, as well as the total mood disturbance score, with 90 women with breast cancer (Speca et al., 2000).

Negative mood has also been linked with decreased immune function in several studies (e.g., Mathews et al., 2002; Tross et al., 1996). Therefore, the current study added the "gold standard" measure of mood (POMS) to the already-existing outcome measures.

Anxiety

Investigators have found that 44% of patients with cancer reported some anxiety and 23% reported significant anxiety (Schag & Heinrich, 1989; Stark, Kiely, & Smith, 2002). Anxiety can be part of normal adaptation to cancer. In most cases, the reactions are time-limited and may motivate patients and families to take steps to reduce anxiety (e.g., gain information), which may assist in adjusting to the illness. However, anxiety reactions that are prolonged or unusually intense are classified as adjustment disorders. These disorders can negatively affect QOL and interfere with a cancer patient's ability to function socially and emotionally. Therefore, anxiety was included in the current study and was evaluated in relation to the other variables.

Anxiety is one aspect of mood that has generally been reduced by participation in stress management, relaxation, and CAM intervention studies. For example, Gaston-Johansson et al. (2000) found that a group intervention of education, cognitive restructuring, and relaxation techniques significantly reduced anxiety, nausea, and fatigue in 52 women. Similarly, Rawl et al. (2002) conducted a randomized study comparing anxiety management training (consisting of progressive muscle relaxation and cognitive restructuring) with a wait-list control group in a 109 cancer patients and found significant reductions in anxiety. In an attempt to replicate the landmark Fawzy and colleagues study (Fawzy et al., 1990) Fukui et al. (2000) also found that a multi-component intervention that included relaxation training resulted in anxiety reductions with women with breast cancer.

Although Benson (1975) once proposed that all relaxation techniques elicit the same "relaxation response," others (Davidson & Schwartz, 1976; Lehrer et al.,1980;

Rausch, 2006) suggest that different interventions may elicit different effects. Specifically, they propose that cognitive-based interventions, such as SG, will reduce cognitive anxiety, whereas somatic-based interventions, such as TCH will reduce somatic anxiety. Therefore, the present study included an anxiety measure that differentiates both cognitive and somatic anxiety (Smith Anxiety Scale; Smith, 1990).

Coping

The experience of breast cancer is worse for some patients than others. There is every reason to believe that differences in coping play a role in the success with which patients adapt to the experience (Anderson, 1992; Holland & Rowland, 1987). Various studies have indicated that particular coping patterns are associated with beneficial outcomes, and coping patterns change over time (Ben-Zur et al., 2001; Carver et al., 1993; Heim et al., 1993; Jarrett et al., 1992; Rosberger et al., 2002). For instance, in one study with 250 women with breast cancer, positive problem solving and seeking social support were both associated with increased QOL (Rosberger et al., 2002). Additionally, after the 250 women participated in either a problem-focused or an emotion-focused coping workshop, differential changes in coping occurred after each workshop. Those in the emotion-focused workshop reduced their escape/avoidance coping, and those in the problem-focused workshop increased their positive-problem solving (Rosberger et al., 2002). Learning a new coping skill such as TCH may influence how patients cope with their stress and illness.

Perceived Stress

Since the first definite link connecting emotional stress with cancer was forged (Snow, 1893), a large number of studies have been conducted on both animal and human

subjects exploring the relationship between psychosocial stress and cancer (Cooper, 1984; Cooper, 1988). In recent years, there has been a great deal of interest shown in the link between stress and breast cancer. Psychological stress has been directly linked with increased depressive mood and other indicators of psychological distress or negative affect in several studies among persons with cancer (e.g., Gerits & De Brabander, 1999; Larson et al., 2000; Mathews et al., 2002; Tross et al., 1996). There is also increasing evidence of associations between psychological distress and immunosuppression or disease progression in persons with cancer (e.g., Kogon et al., 1997; Lechin et al., 1990; Levy, 1990, Levy et al., 1991). The specific role of perceived stress in relation to the other variables was evaluated in the current study.

QOL

Breast cancer patients experience physical symptoms and psychosocial distress that adversely affect their QOL. (Andersen, 2002; Ganz et al., 1996; Spencer et al., 1999; Stagina et al., 2001). QOL generally consists of a number of domains including physical well-being, functional well-being, emotional / psychological well-being (such as levels of anxiety and depression), and social support. There are many different phases of cancer treatment (e.g., diagnosis, consultations, radiation) which present unique issues related to QOL. Chemotherapy, for example, is one form of treatment that can cause physical and psychological problems that adversely affect patient QOL (Seidman et al., 1995).

Since the time of Hippocrates, QOL has been an implied medical outcome (Ganz, 1994; Strain, 1990). In 1948, Karnofsky et al. reported the first effort of physicians to assess systematically the effect of cancer treatments on patients' QOL, not just on their *quantity* of life. QOL instruments currently are being used in clinical trials to predict

survival, response to treatment, and to screen for psychological morbidity (Velikova, 1999).

We were specifically interested in how QOL was impacted as a result of participation in the interventions, as well as relationships with other variables. Similarly, in a sample of 51 women with various stages of breast cancer, Kinney et al (2003) evaluated the effects of a mind-body-spirit intervention. After completing the 12-week intervention, participants reported significant improvements on three QOL measures (FACT-B, FACIT-SP, and Perceived Wellness Survey). Similarly, in a sample of 191 women recently diagnosed with breast cancer, Levine and Targ (2002) evaluated correlates of QOL domains. They found that physical and functional QOL were related to spiritual QOL, and that lower levels of distress (as measured by subscales of the POMS) were consistently related to higher QOL. Additionally, after a 12-week CAM support intervention, they found significant improvements in all QOL domains relative to standard group support (Targ & Levine, 2002). In an 8-week mindfulness-based stress reduction intervention for 42 patients with prostate and breast cancer, Carlson et al (2003) found improvements in overall QOL. Understanding the effect of breast cancer treatment on a patient's QOL has been a central clinical and research question. Therefore, we also included QOL as a variable of interest to the current study.

Summary

Several breast cancer studies have found main effects, as well as mediational pathways between dispositional predictors and situational outcome variables (e.g., Andersen, 2002; Antoni et al., 2001; Carver et al., 1993; Schmidt & Andrykowski, 2004; Speca et al., 2000). Although it is extremely important to understand main effects - which

variables predict change (e.g. interventions, personality characteristics) - it is just as important to understand whether there are other factors that contribute to that change. Mediational relationships further reveal psychosocial mechanisms of action. For example, optimism has consistently been associated with beneficial outcomes in cancer patients. However, rarely have the mechanisms of action in optimism been investigated, although what has been done has shown different mediators are involved in the relationship between optimism and beneficial outcomes (Carver, 1993). In one study, optimists had different coping strategies and better health habits (Carver, 1993), in another, optimists had different levels of distress, and different patterns of social activities (Schou et al., 2004). These other factors may be as important or concomitant with the actual predictors. To address these inconsistent and little-examined issues, the present study evaluated main effects and mediational pathways between dispositional and situational variables.

CHAPTER II

Statement of the Problem

One in seven women will develop breast cancer in the U.S. throughout their lifetime (ACS, 2004), and over 200,000 women in the U.S. are diagnosed with breast cancer each year (ACS, 2004). Progress in both early detection and treatment of breast cancer has resulted in decreasing mortality rates in most segments of the population during the 1990s. More than 90% of breast cancers are now diagnosed at localized and regional stages, for which 5-year survival rates are 97% and 79%, respectively (ACS, 2004). However, the diagnosis of this disease and its treatment are often accompanied by emotional distress, precipitated and exacerbated by fear, symptoms, and functional losses.

To alleviate distress, facilitate coping, and promote healing, persons diagnosed with cancer often turn to CAM, in fact 80% of cancer patients report using CAM (Bernstein, 2001). Stress management and CAM interventions have proven to be beneficial for this population, however, little is known about the mechanisms of these techniques and their application in illness-specific populations like breast cancer. NCCAM's first research priority includes "emphasis on studies of the mechanisms underlying CAM approaches (NCCAM, 2004)." Rigorous evaluations of CAM are therefore necessary to determine the psychosocial mechanisms of action: which approaches work, for whom they work, and how they work in specific medical populations.

Therefore, this project examined the effects and psychosocial mechanisms of action among a subsample who were enrolled in a larger NCI-funded study (R01 CA114718; McCain, PI). The larger study is a randomized-controlled clinical trial

evaluating two 10-week CAM interventions, TCH and SG on PNI outcomes with a sample recently diagnosed with breast cancer. The current study focused on dispositional predictors (optimism, attentional style, emotional intelligence) of mood, stress, coping, QOL, and immune functioning. Additionally, potential mediating variables were evaluated.

Currently, there are several studies emerging suggesting that dispositional variables are related to beneficial outcomes in persons with cancer. Optimism, attentional style, and emotional intelligence have been shown to be relevant to this population. Not all studies, however, are specific to breast cancer populations. Additionally, promising results have yet to be replicated. Therefore, the current project was undertaken to further examine the relationship between the selected variables among a subsample of women who were enrolled in a larger NCI-funded study (R01 CA114718; McCain, PI).

Hypotheses

The specific hypotheses of this project involved evaluating the psychosocial effects of 10-week alternative stress management interventions in the context of a more comprehensive study with women recently diagnosed with breast cancer. Because this is an innovative treatment design, specific predictions were more difficult to make. However, based on the extant literature, the following specific hypotheses were made:

1. The first hypothesis predicted that the two interventions, TCH and SG, would reduce total mood disturbance relative to the CTRL group, as measured by the POMS and the CESD, and improve QOL as measured by the FACT-B

2. The second hypothesis predicted that the dispositional variables (optimism, attentional style, and EI) would be associated with change in outcomes from pre- to post-

intervention. Although we were interested in the predictive value of each dispositional variable (optimism, attentional style, and EI) on each outcome variable (QOL, mood, stress, and immune function), the number of analyses required to explore those interests far exceeds the parameters of a dissertation project. Therefore, for the purpose of this dissertation, we limited our analyses to three specific hypotheses related to the predictive value of each dispositional variable. They were as follows:

2a) Higher levels of optimism were hypothesized to predict improved immune function.

2b) Higher levels of blunting were hypothesized to predict greater reductions in anxiety.

2c) Higher levels of emotional intelligence were hypothesized to predict greater reductions in perceived stress.

3. The third hypothesis predicted that particular state variables would mediate beneficial effects in outcomes. Specifically, it was predicted that:

3a) Coping would mediate the relationship between optimism and improved immune function (see Figure 1a on page 22).

3b) Anxiety would mediate the relationship between attentional style and QOL (see Figure 1b on page 22).

3c) Stress would mediate the relationship between EI and QOL (see Figure 1c on page 22).

4. The fourth hypothesis predicted that there would be differential effects of the two interventions (TCH and SG) on cognitive and somatic anxiety.

Specifically, it was predicted that those in the TCH group would show greater reductions in somatic anxiety, whereas those in the SG would show greater reductions in cognitive anxiety, relative to each other (see Figures 2a and 2b on page 23).

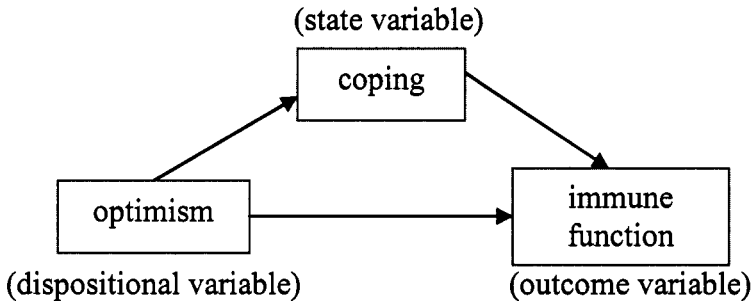


Figure 1a. Hypothesis 3a: Mediational relationship of coping between optimism and immune function

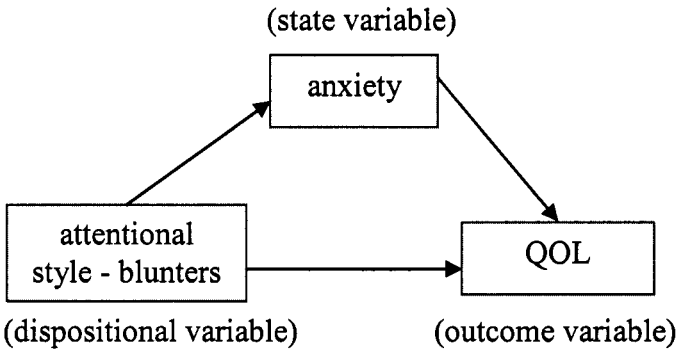


Figure 1b. Hypothesis 3b: Mediational relationship of anxiety between attentional style and quality of life (QOL)

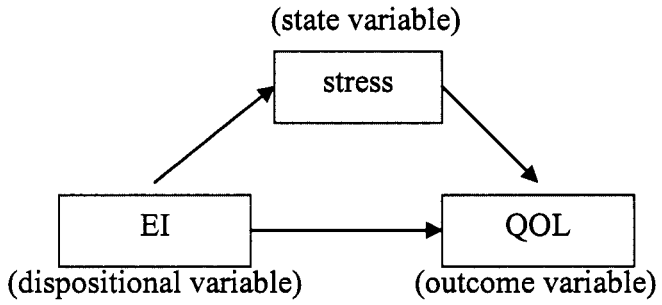


Figure 1c. Hypothesis 3c: Mediational relationship of stress between Emotional Intelligence (EI) and quality of life (QOL)

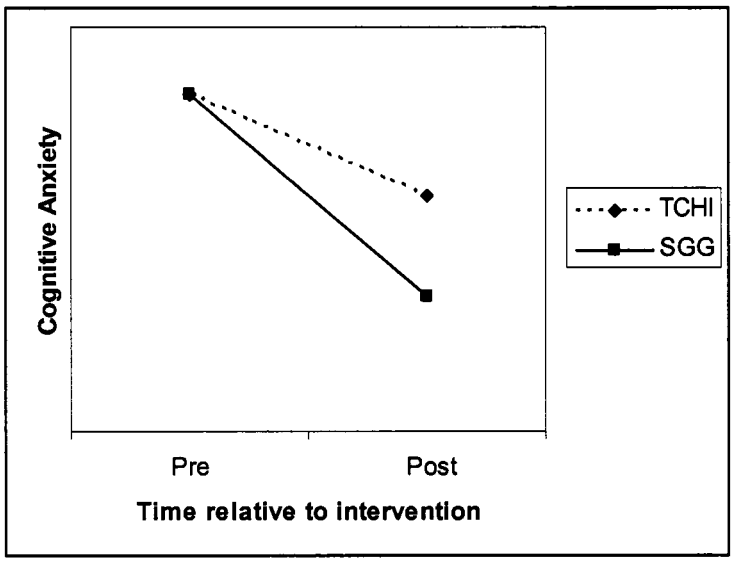


Figure 2a. Hypothesis 4: Predicted data from the Smith Anxiety Scale: Cognitive anxiety

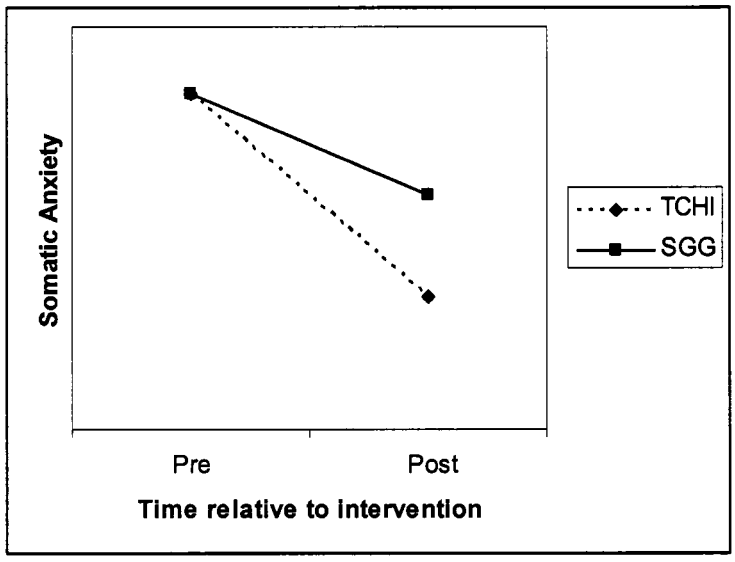


Figure 2b. Hypothesis 4: Predicted data from the Smith Anxiety Scale: Somatic anxiety

CHAPTER III

Research Design and Methods

As mentioned in the introduction, the current study was a sub-study of a larger NCI-funded study (R01 CA114718; McCain, PI). Whereas the larger study focuses on a greater number of participants, 2-year follow-up, and biological mechanisms of action, the current sub-study focused primarily on psychosocial mechanisms. Methods for the current sub-study are a reflection of the methodology in place for the larger study.

Objective. The objectives of this study were to determine the psychosocial mechanisms of action in a larger 10-week intervention study of either TCH or SG groups in a recently diagnosed breast cancer sample by evaluating: (1) which intervention works for whom; (2) mediational effects between dispositional and situational variables; and (3) differential effects of the two interventions (TCH and SG).

Design. The larger study used a controlled, randomized, between- and within-subject design testing the influence of TCH and SG as complementary stress management interventions in comparison to a no-treatment control group that will receive standard health care. A pretest-posttest design with repeated measures will be used.

Participants

The subsample for the current study was comprised of 40 women who underwent initial surgical treatment (lumpectomy or mastectomy and axillary node resection) and who were, at the time of their enrollment, about to begin adjuvant chemotherapy for Stage I or II breast cancer. Of the 40 participants, most (73%, $n = 29$) were Caucasian, 22% ($n = 9$) were African American, and 5% ($n = 2$) identified themselves as "other"

racial designation. The mean age of the sample was 49 years with a range of 33-69 years. As for the intervention groups, 29 participants completed the 10-week intervention and both time 1 (T1) and time 2 (T2) data. There were 15 participants who completed the TCH group, 6 participants who completed the SG group, and 8 who completed the CTRL group.

Data collection problems emerged throughout the duration of this study. First, T2 data collection packets did not include the LOT, and therefore there are no data available for this variable at T2. Additionally, for a period of 6 months, the measures of specific interest for this study were not given to participants during data collection, and therefore, a substantial number of participants do not have data available on these measures either at T1 or T2. Therefore, depending on the variables being analyzed different numbers of participants were included in the analyses.

Inclusion/Exclusion Criteria. All participants were required to be 21 years of age or older. Participants were also required to read and speak English, be physically capable of participating in a 10-week intervention (ECOG Performance Status score ≥ 2 [Oken et al., 1982]), and be capable of providing informed consent. Participants with significant cognitive impairment (as evidenced by a score ≤ 19 on the Cognitive Capacity Screening Examination [Jacobs, Bernhard, Delgado, & Strain, 1977]) or psychiatric impairment (e.g., mental retardation, active psychoses or dissociative disorders, or unstable and/or severe depressive illness [as documented in the chart or by patient history]) were not eligible for the study.

Less than 1% of all breast cancers occur in males (Jemal, Thomas, Murray, & Thun, 2002), and breast cancer in children is virtually non-existent. Thus, men and children were not included in this study.

Methods

Recruitment and Retention

Participants were recruited through the specialty clinics of Massey Cancer Center (MCC), at the Virginia Commonwealth University Health System (VCUHS) medical center campus and the Stony Point campus, where there are approximately 200 women treated each year for early breast cancer. In this population, standard adjuvant chemotherapy regimens consist of cyclosphosphamide and doxorubicin, with or without taxane. About 30% of patients receive radiation therapy after chemotherapy. This relatively homogeneous population, diagnosed and treated by a select health care group provided a strong measure of control for extraneous treatment variables for the purposes of this study.

Personnel at MCC were committed to assist with recruitment through placement of brochures and direct communications with and referral of patients. To enhance participation, particularly among persons with lower socioeconomic status, parking fees, round-trip bus tickets, and childcare services were offered. A study investigator obtained informed consent from each participant. Eligible participants were provided oral and written information about the research and provided an opportunity to ask questions or discuss the study with family or significant others. Participants were asked to provide witnessed, written informed consent prior to any data collection.

Generally, all needed medical information was provided by the participant during the enrollment process. However, participants' medical records were used to validate diagnoses and plans for adjuvant therapies. Participant confidentiality was maintained in all recordkeeping, oral communications, and publications. In compliance with confidentiality standards, as well as HIPAA requirements, no patient identifying information was entered into the computerized database.

Data Collection Procedures

Data collection took place either at the General Clinical Research Center (GCRC) or at the Stony Point campus clinic (based on convenience for the participant) within the Virginia Commonwealth University Health System (VCUHS) hospital. Intervention groups were held at MCC's Stony Point clinic in rooms at the clinic designated for the interventions.

Participants were randomly assigned to either the TCH, SG or standard care CTRL group. Data collection for all groups followed the same schedule. Data were collected immediately before the start of the intervention, one week prior to the start of adjuvant chemotherapy. Participants then received prescribed chemotherapy, on a schedule of either every two or three weeks. Data were again collected immediately after completing the 10-week intervention. Virginia Commonwealth University's GCRC and the Stony Point clinic were used to coordinate all data collection. To the fullest extent possible, data collection was scheduled to coincide with clinic appointments, and all blood for clinical purposes were drawn at the time of study venipunctures.

Following study enrollment, randomization, and initial collection of demographic, cofactor, and health status data, participants were scheduled for return visits. Appointment cards were given to participants and they were telephoned 2-3 days before their scheduled return visits to confirm appointments.

On data collection days, an investigator administered study questionnaires, which required approximately 55 minutes for completion. A GCRC staff member or Stony Point nurse collected approximately 60 ml of blood in vacutainers.

To avoid any additional burden, participants were given the option to take the additional five measures for this dissertation study home and mail them back. Stamped, self-addressed return mailers were provided for the participants' convenience in completing and returning the added measures.

Intervention Protocols

Interventions were conducted with groups of approximately 5 participants who met weekly for 10 weeks. The first group intervention sessions immediately followed pre-intervention data collection. Intervention sessions were conducted in 90-minute sessions, except for the first session, which was 60 minutes, and dealt primarily with introductions and an overview of group session material. Participants who attended less than 7 of the 10 intervention sessions were deemed as having incomplete treatments and were eliminated from analyses.

Focused Tai Chi Group. The focused TCH groups were directed by Dr. Jo Robins (Co-Investigator of the larger study), who also oversaw all operations of the groups that other facilitators lead. Dr. Robins is a member of the sponsor's current research team and

has lead TCH groups in previous research; thus she has had extensive experience with a similar research protocol, and has received expert group and individual training from a TCH master. Based on prior research, and in consideration of potential physical limitations of participants, a focused short form of TCH involving eight movements was used in the clinical trial. The movements can be practiced individually or together to create a TCH form. The protocol involves progressively learning eight movements over 10 weeks. Movements were taught in a sequence that allowed repetitive instruction as well as a progressive building of skills. Training videotapes/DVDs were distributed to participants for weekly and ongoing home practice of the techniques.

Spiritual Growth Group: The SG groups were directed by Dr. Inez Tuck (Co-Investigator of the larger study), who has extensive experience in leading groups and assisting individuals in exploring their spirituality. The protocol for this study was the SPIRIT-10© (Tuck, 2000), a standardized intervention that has been used in different medical populations. The intervention was designed for the personal exploration and communal sharing of spirituality by participating in activities designed to facilitate understanding and appreciation of spirituality. The group sessions began and ended with quiet time spent in reflection and contemplation with music in the background. The facilitator lead the activity for the session, which included selected readings with discussion, viewing of video clips, and creative expression through art. Each session was designed to explore an aspect of spirituality and included the intellectual process of knowing or apprehending spirituality; the experiential component of interconnecting one's spirit with self, others, nature, God, or a higher power, and an appreciation of the

multi-sensory experience of spirituality. The facilitator articulated the intent of each activity by encouraging discussion of the relevance of the activity to spirituality. The SPIRIT-10© intervention supports secular, religious, and nonreligious views of spirituality in a group format.

Measures

Measures Added to the Larger Study

All of the psychobehavioral measures were chosen due to their theoretical relevance, excellent psychometric properties, and standard use in intervention research.

The Revised Life Orientation Test (LOT-R). The LOT-R (Scheier, Carver, & Bridges, 1994) measures dispositional optimism, which is defined as general positive outcome expectancies. Three items are positively phrased ("In uncertain times I usually expect the best"), and three items are negatively phrased ("If something can go wrong for me it will). An additional four items are fillers. Respondents indicate their agreement with each item on a 5-point scale ranging from *strongly agree* (1) to *strongly disagree* (5). The LOT-R has acceptable psychometric properties and discriminant validity with respect to related concepts. Alpha reliability has been above 0.90.

Miller Behavioral Styles Scale (MBSS). The MBSS (Miller, 1987) measures dispositional attentional coping style and is used to categorize "monitors" and "blunters." The MBSS describes four hypothetical, uncontrollable, non-medical situations designed to evoke stress and discomfort, and individuals indicate how they would respond to that situation. Three scores can be derived from the MBSS: a total monitoring score, a total blunting score, and a sum score calculated by subtracting blunting from the monitoring

total. Using a median (or mean) cutoff score, a sample may be divided into high and low monitors and blunters or simply into monitors and blunters on the basis of the sum score. Alpha reliability has been 0.92.

Trait Meta-Mood Scale (TMMS). The TMMS (Salovey et al., 1995) is a 30-item dispositional measure of emotional intelligence. The TMMS is conceptually based on the EI construct (Mayer & Salovey, 1993; Salovey & Mayer, 1990) and was developed to identify individual differences that characterize EI (Salovey et al., 1995). The TMMS yields three subscale scores as well as a total composite score. The Attention to Feelings subscale indexes the amount of attention individuals feel they give to emotions and includes items such as "I pay a lot of attention to how I feel." The Clarity of Feelings subscale measures how clearly individuals feel they understand their emotions and includes items such as "I am usually very clear about my feelings." The Mood Repair subscale measures the individual's ability to repair unpleasant moods or maintain pleasant ones. Items on this subscale include "I try to think good thoughts no matter how badly I feel." Items are scored on a 5-point Likert-type scale ranging from *strongly disagree* (1) to *strongly agree* (5). Coefficient alpha for the total score in previous studies has been 0.88.

Profile of Mood States (POMS). The POMS (McNair, Lorr, & Droppleman, 1971) is a measure of mood state over the previous week. Respondents rate how much they have been feeling each of 65 different items reflecting mood on a 5-point scale ranging from *not at all* (0) to *extremely* (4). The scale yields a Total Mood Disturbance score which is comprised of six subscales measuring: tension-anxiety, depression-dejection,

anger-hostility, fatigue-inertia, vigor-activity, and confusion-bewilderment. The POMS has high internal consistency (0.74 to 0.91 for the subscales) and good validity.

Smith Anxiety Scale (SAS). The SAS (Smith, 1990) is used to evaluate both cognitive and somatic anxiety levels. Respondents rate how much they agree with statements related to experiencing different cognitive and somatic aspects of anxiety on a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5). Scores from this measure yield a cognitive anxiety subscale, a somatic anxiety subscale, and a total anxiety score. Alpha reliability has been 0.89-0.92.

Existing Measures in the Larger Study

Psychosocial Measures. Of interest to this study were psychosocial measures of perceived stress (Impact of Events Scale), depression (CESD), coping (Ways of Coping), , and QOL (FACT-B). A table of all measures included in the larger study is included as Appendix A. Measures of interest to the current sub-study are described briefly herein.

Impact of Events Scale (IES). The IES (Horowitz, Wilner, & Alvarez, 1979) measures perceived stress. The IES is based on a 2-factor *intrusion-avoidance* model of reactions to stressful life events. Intrusions are characterized by unbidden thoughts and images, troubled dreams, or strong waves of feelings. Avoidance responses are characterized by denial of the meaning and consequences of an event. This 15-item scale assesses the degree of subjective stress in response to a specific stressful event, in this case, diagnosis and treatment of breast cancer. Participants rate the frequency of intrusive and avoidant thoughts in the past 7 days using a 4-point frequency scale. The two subscales are avoidance (8 items, range 0-40) and intrusion (7 items range 0-35), as well

as a total score (range 0-75), with higher sores representing higher levels of perceived stress. Standardization studies have reported the following meaningful ranges for the total score of the IES: 0-8 = subclinical levels of stress; 9-25 = mildly significant levels of stress; 26-43 = moderately significant stress response scores; $\geq$ 44 = severe post-traumatic stress response (Devilly, 2005). The IES has been frequently used in chronic illness populations, especially studies with women newly diagnosed with breast cancer. The IES consistently has been shown to be a reliable and valid instrument with Cronbach's alpha reported at 0.91 (Osowiecki & Compas, 1998).

Center for Epidemiological Study of Depression (CESD). The CESD (Radloff, 1977), is a 20-item scale developed for the Center for Epidemiologic Studies (for validity data see Myers & Weissman, 1980; Schulberg et al., 1985). The CESD, which is widely used in research, measures a range of cognitive, affective, motivational, and somatic symptoms (framed as first-person sentences). Response options range from *rarely* (0) to *most of the time* (3). The mean alpha across administrations was reported at 0.89 (Antoni et al., 2001). A score of 16 is viewed as a moderately severe level of depressive symptoms (Myers & Weissman, 1980; Radloff, 1977; Schulberg et al., 1985).

Ways of Coping Questionnaire (WAYS). The WAYS (Folkman & Lazarus, 1980, 1988) yields the following subscales: (a) *Confrontive Coping* describes aggressive efforts to alter the situation and suggests some degree of hostility and risk-taking; (b) *Distancing* describes cognitive efforts to detach oneself and to minimize the significance of the situation; (c) *Self-Controlling* describes efforts to regulate one's feelings and actions; (d) *Seeking Social Support* describes efforts to seek informational support, tangible support,

and emotional support; (e) *Accepting Responsibility* acknowledges one's own role in the problem with a concomitant theme of trying to put things right; (f) *Escape-Avoidance* describes wishful thinking and behavioral efforts to escape or avoid the problem; (g) *Planful Problem Solving* describes deliberate problem-focused efforts to alter the situation, coupled with an analytic approach to solving the problem; and (h) *Positive Reappraisal* describes efforts to create positive meaning by focusing on personal growth.

Functional Assessment of Cancer Therapy-Breast (FACT-B). The FACT-B is a multidimensional quality of life questionnaire developed for breast cancer patients (Cella, Tulsky, & Gray, 1993). It consists of the FACT-G, a QOL measure for any cancer patient which assesses physical, social, emotional, and functional well-being. The FACT-B has five subscales including: physical well-being (7 items; range = 0-28), social/family well-being (7 items, range = 0-28), emotional well-being (6 items, range = 0-24), functional well-being (7 items, range = 0-28), and additional concerns specific to breast cancer (10 items, range = 0-40). This instrument has excellent validity and reliability properties in breast cancer (Beaulac et al., 2002; Coster et al., 2001)

Biological Measures. The immune measures selected for the larger study include both Type I and Type II cytokines. In general, Type I cytokines favor the development of a strong cellular immune response whereas Type II cytokines favor a strong humoral immune response. The Type I cytokines included interferon-gamma (IFN-γ), tumor necrosis factor-alpha (TNF-α), interleukin-1β (IL-1β), interleukin-2 (IL-2), and interleukin-12 (IL-12). The Type II cytokines included interleukin-4 (IL-4), interleukin-6 (IL-6), and interleukin-10 (IL-10).

All cytokines were measured by blood sample. All assays for these variables were conducted by experienced personnel in Dr. McCain's research laboratory. BioRad BioPlex assays were utilized, which are multiplex bead-based assays based on xMAP technology and optimized for the Bio-Plex suspension array system. Interassay variability was controlled through cryopreservation of mononuclear leukocytes. Using BD Vacutainer™ CPT tubes, peripheral blood mononuclear cells were separated from plasma by a gelbarrier upon centrifugation. PHA-stimulated cellular production of the cytokines were measured with standard assay kits. (1%vol/vol; Gibco). Culture supernatants were collected at 24 hours for determination of Il-2 production levels, and at 72 hours for all other cytokine assays.

CHAPTER IV

Results

Preliminary Analyses

Age and race of participants were evaluated in relation to all other variables. Older age was significantly correlated with race ($r = -.39, p < .05, n = 40$) such that African American participants were younger. Correlations also indicated that African American race was significantly correlated with lower levels of seeking social support at T2 ($r = -.55, p < .05, n = 17$), planful problem solving at T2 ($r = -.56, p < .05, n = 14$), and increases in benefit finding over time ($r = -.51, p < .05, n = 17$).

A series of ANOVAs were conducted to evaluate whether there were any significant group differences at baseline on any of the demographic or psychosocial measures. There were no significant differences among groups on any of the baseline measures, except for monitoring (MBSS) [$F(2,8)=3.89, p<.05$]. Post hoc analyses using Bonferroni's revealed that the means for the TCH group and the CTRL group were significantly different from each other such that those in the TCH group had higher levels of monitoring than those in the CTRL group (see Table 1 on p. 38).

Changes from Pre- to Postintervention

Changes from T1 to T2 were evaluated independent of the intervention group to which subjects were assigned. It may be noted in Table 2 (p. 39) that for some measures there was considerable attrition at T2, resulting in very small samples for evaluation of change. To evaluate whether the change in scores from T1 to T2 were significant, a series of paired samples t-tests were conducted. It should be noted that the means represented in

Table 2 are the means for all subjects available for each time point. *T*-tests were conducted only on subjects who had data available at both T1 and T2. The *t*-tests revealed that the only significant changes at $p<.05$ in scores from T1 to T2 were an increase in use of distancing (WAYS) as a coping strategy ($t= -2.55$, $p<.05$). This analysis was based on 15 subjects (T1 Mean=5.53, *SD* = 3.85; T2 mean=7.47, *SD*=3.54). The second significant finding was for physical QOL (FACT-B) ($t = 6.02$, $p<.01$). This analysis was based on 20 subjects (T1 mean=23.65, *SD*=4.46; T2 mean=17.5 *SD*=4.45). Finally, the third significant finding was for emotional QOL (FACT-B) ($t = -2.24$, $p <.05$) This finding was based on 22 subjects (T1 mean=16.68, *SD*=4.98; T2 mean=18.87, *SD*=3.83). Because of the number of variables analyzed these changes should be viewed with caution.

Relationships Among Dispositional Variables

To evaluate relationships among the dispositional variables, correlational analyses were conducted with all T1 dispositional variables. These correlational analyses revealed that none of the dispositional variables were correlated with each other, suggesting a good degree of independence among the variables. The only significant correlations, as reported below in Table 3 (p. 40), are those between subscales of the same measure (the TMMS), as was expected.

Table 1. *Means of Measures by Intervention Group at Baseline*

	[illegible]	[illegible]	[illegible]
Optimism (LOT)	21.5	24.0	26.75
Monitoring* (MBSS)	11.17	10.20	8.71
Blunting (MBSS)	3.45	3.5	4.5
EI Mood Repair	23.89	25.67	26.0
EI Clarity of Feeling	38.33	40.33	39.0
EI Attn to Feelings	49.22	48.67	47.33
EI Total (TMMS)	99.5	101.0	111.75
IES Total	29.5	23.0	21.75
IES Intrusive	13.0	10.0	10.5
IES Avoidant	15.5	13.0	11.25
CESD	11.67	6.5	27.0
POMS Tension	19.91	15.5	19.0
POMS Depression	20.09	17.0	21.17
POMS Anger	17.73	13.5	17.17
POMS Vigor	20.73	30.25	25.83
POMS Fatigue	17.55	10.25	13.33
POMS Confusion	17.09	11.25	13.17
POMS Total Mod Dist	92.36	77.5	83.83
Cognitive Anxiety	13.9	11.75	16.5
Somatic Anxiety	34.91	25.5	30.5
Total Anxiety	48.0	33.0	34.75
WAYS Confrontive	5.0	3.25	3.0
WAYS Distancing	6.25	5.0	4.75
WAYS Self-Controlling	6.63	7.5	7.5
WAYS Seeking Soc. Sup	12.88	11.50	10.25
WAYS Acc Resp	1.63	1.25	2.25
WAYS Esc / Avoid	6.88	3.25	7.25
WAYS Plan. Prob Solv	9.38	7.5	8.75
WAYS Pos Reappraisal	11.5	9.5	13.75
Physical QOL	22.0	26.8	23.0
Social QOL	19.0	28.0	25.5
Emoitonal QOL	17.64	19.4	14.8
Functional QOL	19.0	26.0	21.0
Brst Cancer QOL	17.36	20.0	17.6
Total QOL	100.18	113.6	98.0

* = $p < .05$

Table 2. *Means of Measures at Time 1 and Time 2.*

	Time 1			Time 2		
Measure	Mean	*SD*	*n*	Mean	*SD*	*n*
Optimism	24.58	3.06	24	-	-	-
MBSS Monitoring	9.56	2.52	36	9.44	2.96	9
MBSS Blunting	3.92	2.30	36	5.11	1.76	9
EI Mood Repair	23.05	3.52	37	21.11	2.31	13
EI Clarity of Feelings	36.49	8.83	35	32.22	6.98	13
EI Attention to Feelings	47.17	5.99	35	46.78	5.05	13
EI Total	106.64	15.30	33	100.11	8.43	13
IES Total	24.58	17.73	24	20.57	15.95	21
IES Intrusive	12.29	9.73	24	9.18	7.34	22
IES Avoidant	11.92	8.98	25	11.29	9.48	21
CESD	13.16	10.65	25	12.71	10.29	21
POMS Tension	20.03	7.06	34	19.00	6.52	13
POMS Depression	22.37	9.63	35	25.62	5.60	9
POMS Anger	18.00	7.33	34	18.00	3.38	9
POMS Vigor	23.26	7.13	35	21.13	6.58	9
POMS Fatigue	15.88	7.32	33	16.50	6.59	8
POMS Confusion	15.29	5.52	34	14.13	4.29	9
POMS Total Mood Disturbance	87.00	25.67	31	93.25	19.96	8
Cognitive Anxiety	15.94	7.20	36	14.44	5.53	9
Somatic Anxiety	33.26	13.47	35	37.44	9.15	9
Total Anxiety	49.11	18.44	35	51.89	13.86	13
WAYS Confrontive	4.27	1.75	22	4.35	3.35	17
WAYS Distancing	5.42	3.08	24	7.75	3.61	16
WAYS Self-Controlling	7.21	3.06	24	7.59	3.83	17
WAYS Seeking Social Support	12.04	3.51	25	10.65	4.76	17
WAYS Accepting Responsibility	2.32	2.25	22	2.19	2.51	16
WAYS Escape/Avoidance	6.39	3.96	23	5.47	4.37	15
WAYS Planful Problem Solving	8.27	3.30	22	9.07	3.67	17
WAYS Positive Reappraisal	11.04	5.17	23	11.31	5.20	17
FACT Physical QOL	28.33	4.28	24	16.86	4.83	22
FACT Social QOL	23.52	3.06	23	21.55	5.74	20
FACT Emotional QOL	17.23	4.80	26	18.86	3.83	22
FACT Functional QOL	19.31	5.35	26	18.73	5.92	22
FACT Breast Cancer Specific QOL	16.73	4.22	26	16.82	4.21	22
FACT-Total QOL	102.86	14.76	21	92.70	16.79	20

Table 3. *Correlations Between Dispositional Variables at Baseline*

Measure:	***Statistic***	1.	2.	3.	4.	5.	6.	7.
1. Optimism	*Pearson Correlation*	1						
	Significance	.						
	n	24						
2. TMMS (EI) Total	*Pearson Correlation*	.12	1					
	Significance	.60	.					
	n	22	33					
3. TMMS (EI) Mood Repair Subscale	*Pearson Correlation*	.25	.74**	1				
	Significance	.24	.00	.				
	n	24	33	37				
4. TMMS Clarity of Feelings subscale	*Pearson Correlation*	.17	.92**	.66**	1			
	Significance	.43	.00	.00	.			
	n	23	33	35	35			
5. TMMS Attention to Feelings Subscale	*Pearson Correlation*	-.17	.72**	.29	.43**	1		
	Significance	.45	.00	.10	.01	.		
	n	23	33	35	33	35		
6. Blunting (MBSS)	*Pearson Correlation*	.35	-.08	.05	-.09	-.11	1	
	Significance	.10	.68	.79	.62	.53	.	
	n	24	32	36	34	34	36	
7. Monitoring (MBSS)	*Pearson Correlation*	-.34	-.10	-.08	-.23	.22	-.21	1
	Significance	.10	.61	.63	.20	.22	.22	.
	n	24	32	36	34	34	36	36

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Hypothesis 1: Effects of TCH and SG Interventions Compared to Control Group

The first hypothesis predicted that the two interventions, TCH and SG would reduce distress relative to the CTRL group, as measured by the POMS total mood disturbance and CESD, and improve QOL as measured by the FACT-B. Because different groups of subjects were available who provided pre-post data on each measure three separate ANOVAs were conducted rather than a multivariate analysis. First, 2 x 2 repeated measures ANOVAs were used with group designation (intervention groups [by combining both the TCH and SG groups] and control group) as the between subjects variable and time (pre-post) as the within subjects variable. If these results were significant, then post-hoc analyses were conducted to evaluate differential effects of the three interventions.

The first 2 (intervention grps vs ctrls) x 2 (time points) repeated measures ANOVA was conducted with T1 and T2 POMS total mood disturbance scores as the dependent variables. Unfortunately, the number of subjects who completed both T1 and T2 data with the POMS was very low (n=5). Even though the number was low, there were some marginal results. There were no significant main effects for either time or group. A marginally significant group x time interaction effect emerged: F (1,5) =52.08, p=.08, Wilk's Lambda=.02, partial eta squared =.98. Post hoc analyses using Bonferroni's revealed that participants who completed the POMS at T1 and T2 were only comprised of those in the TCH and CTRL group. An inspection of the means indicated that those in the CTRL group reported significantly more increase in their total mood disturbance scores than those in the TCH group. See Table 4 (p. 43) below for means.

Next, a 2 (intervention grps vs ctrls) x 2 (time points) ANOVA was conducted with T1 and T2 CESD as dependent variables. There were no significant results for the main effects of either time or group. A significant time x intervention group interaction emerged: F (2,20) = 7.01, p < .05, Wilk's Lambda = .72, partial eta squared = .28. Post hoc analyses utilizing Bonferroni's with planned comparisons indicated that each group was significantly different from the other two (p < .05). Inspection of the means indicated that those in the CTRL group had the greatest decrease in depressive symptoms, those in the SG group had a smaller decrease in depressive symptoms, whereas those in the TCH group had increases in depressive symptoms. See Table 4 (p. 43) for means.

Additionally, a 2 (intervention grps vs ctrls) x 2 (time points) ANOVA was conducted with T1 and T2 FACT-B Functional QOL as the dependent variables. There were no main effects for group or time. There was a significant group x time interaction: F(1,22) =4.79, p<.05, Wilk's Lambda =.81, partial eta squared = .19. Post hoc analyses using Bonferroni's with planned comparisons indicated that for functional QOL there was a significant difference across time between the TCH and CTRL groups (p<.05). Specifically, those in the TCH group reported a slight decrease in functional QOL, whereas those in the control group reported an increase in their functional QOL. See Table 4 (p. 43) for means.

Table 4. *Means of POMS, CESD, and FACT-B Functional QOL by Intervention Group*

Intervention Group	T1 Mean (*SD*)	*T2 Mean (SD)*	*N*
POMS Total Mood Disturbance			
TCH	94.0 *(12.72)*	103.0 *(15.56)*	3
CTRL	66.00 *(18.50)*	100.00 *(11.14)*	2
CESD			
TCH	11.67 *(6.40)*	14.92 *(11.29)*	12
SG	6.5 *(3.70)*	5.5 *(4.20)*	4
Ctrl	27.0 *(17.42)*	10.5 *(9.11)*	4
FACT-B Functional QOL			
TCH	18.92 *(5.50)*	16.77 *(6.39)*	13
SG	23.75 *(3.59)*	23 *(5.35)*	4
Ctrl	16.20 *(6.18)*	20.40 *(2.41)*	5

Hypothesis 2: Relationships between Dispositional Variables and Outcome

The second hypothesis predicted that higher levels of each of the three dispositional variables would predict greater improvements in a state outcome variable after 10-weeks, regardless of intervention. For each hypothesis a hierarchical regression was conducted with demographic variables entered as step 1, and the dispositional predictor variable entered as step 2. The dependent variable for each equation was a change score of the outcome variable. For all variables T1 scores were subtracted from T2 scores, so that positive scores indicated an increase in scores whereas negative scores indicated a decrease in scores. The three specific hypotheses and results follow below.

Hypothesis 2a: Optimism and Immune Function. Higher levels of optimism were hypothesized to predict improved immune function from T1 to T2. Due to the unavailability of T2 immunological data, it was not possible to compute change scores, and this hypothesis was therefore not evaluated. However, sufficient T1 data were available to evaluate the relationship between optimism and T1 immunological status as measured by Type I and II cytokines (n=29). Initial correlational analyses were

conducted (see Table 13 on page 52), and those that were significantly associated with optimism were then fit into the regression equations to evaluate their predictive value above and beyond demographics. Significant results emerged for both TNF-α and IL-10. Because t-tests indicated that race was significantly associated with IL-10 (t= -3.18, p<.01), it was included in the regression equation. Age was also included because age is known to be reliably associated with immune function. Each stepwise hierarchical regression included age and race as step 1, and then optimism as step 2. In the first equation shown below, TNF-α was the dependent variable, and in the second equation, IL-10 was the dependent variable. These analyses revealed that optimism was a significant predictor of TNF-α at T1, accounting for 93% of the variance above and beyond age and race. Although the overall model for IL-10 was significant, the independent contribution of optimism was not significant after age and race were accounted for.

Table 5. *Optimism as a Predictor of Immune Parameters.*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
Model 1: TNF-α					
1. Age, race	.00	.00	.001	-.19	
2. Optimism	.93	.93	25.27*	.98*	
					$F(2,8)$=12.63*
Model 2: IL-10					
1. Age, race	.21	.21	3.76+	.18	
2. Optimism	.36	.15	2.98	.48	
					$F(2,8)$=3.64*

Note: * = p < .05; + = p=.07

Hypothesis 2b: Blunting and Anxiety. Higher levels of blunting were hypothesized to predict greater reductions in anxiety. A regression analysis was conducted with age and race entered in the first step in the equation, and the blunting score entered in the second step in the equation. The change score in the anxiety total score was the DV. The second regression equation evaluated monitoring scores (the converse of blunting) as a predictor of anxiety. As may be noted in Table 6 on page 46, blunting was not a significant predictor of changes in anxiety scores. However, the regression equation with monitor scores revealed a significant overall model. Demographics predicted 72% of the variance in the anxiety change score. Above and beyond the demographics, the monitoring score was marginally significant (p=.09), accounting for an additional 25% of the variance in anxiety. Specifically, higher levels of monitoring predicted decreases in anxiety across time. Additional analyses evaluating whether attentional style interacted with group assignment to produce differential changes in anxiety did not produce any significant results.

Hypothesis 2c: Emotional Intelligence and Perceived Stress. Higher levels of emotional intelligence (EI) were hypothesized to predict greater reductions in perceived stress. A hierarchical regression equation was conducted with basic demographics entered as step 1 in the equation, and the EI total score as step 2. Change in perceived stress (IES total change score) was the DV. There were no significant results for this model (see Table 8 on p. 46).

Table 6. *Attentional Style as a Predictor of Change in Anxiety (SAS Total Score)*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
Model 1: Blunting					
1. Age				-.59	
Race	.72	.72	3.83	.55	
2. Blunting	.73	.01	.05	-.09	
					$F(3,10)=1.76$
Model 2: Monitoring					
1. Age				-1.04*	
Race	.72	.72	3.83	.43+	
2. Monitoring	.96	.25	13.11	-.66#	
					$F(3,10)=17.83$*

Note: * = $p < .05$; + = $p=.06$; # = $p=.09$

Table 7. *Means of SAS Total Anxiety Scores by Attentional Style*

	T1 SAS Total	T2 SAS Total
Low Monitors	*48.44*	*62.25*
High Monitors	*49.06*	*41.5*
Low Blunters	*50.73*	*56.75*
High Blunters	*45.33*	*52.50*

Note: categories for attentional style were calculated using 1 *SD* above and below the mean

Table 8. *EI as a Predictor of Perceived Stress*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
1. Age, race	.00	.00	.04	.02	
2. EI (TMMS total)	.01	.01	.10	.09	
					$F(1,17)=.07$, $p=.76$

Hypothesis 3:Mediational Analyses

The third hypothesis predicted a potential mediator for each dispositional measure and one outcome variable. These mediational relationships were evaluated by regression analyses. The four steps to establish mediational relationships, as outlined by Baron and Kenny (1986) and Judd and Kenny (1981) were followed: (1) the total effect of the independent variable on the dependent variable must be significant; (2) the path from the independent variable to the mediator must be significant; (3) the path from the mediator to the dependent variable must be significant; and (4) if the independent variable no longer has any effect on the dependent variable when the mediator has been controlled, then complete mediation has occurred. The order of these steps were followed for the three hypothesized relationships below. If one step in those outlined above was not significant, then the proceeding steps were not conducted.

Hypothesis 3a: Coping, Optimism, and Immune Function. Coping was hypothesized to mediate the relationship between optimism and improved immune function. As mentioned above in hypothesis 2a, due to the limits of not having T2 immunological data, we were not able to evaluate this hypothesis. Even when evaluating this hypothesis with T1 immunological data, as noted above (p. 44), optimism was a significant predictor of TNF-α, however, coping had no relationships with TNF-α, therefore no further mediational analyses were conducted.

Hypothesis 3b: Anxiety, Attentional Style, and QOL. Anxiety was hypothesized to mediate the relationship between attentional style and QOL. The monitor scale was found to be a significant predictor of change in breast cancer specific QOL and total QOL

(blunting was not related to any QOL indices). In both models, higher levels of monitoring predicted increases in QOL scores. However, monitoring was not related to any anxiety scale of the SAS, and therefore no further steps in the analyses were conducted to evaluate mediation. See Table 9 on page 48 for results.

Table 9. *Monitors and QOL Change Scores*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
Breast Cancer Specific QOL Change Score					
1. Age				-.38	
Race	.22	.22	2.54	.20	
2. Monitor Score	.42	.20	5.82*	.48*	
					$F(3,20)=4.08$*
Total QOL Change Score					
1. Age				-.18	
Race	.07	.07	.48	.30	
2. Monitor Score	.41	.34	7.57*	.61*	
					$F(3,20)=3.00$+

Note: * = $p < .05$; + = p=.06

Hypothesis 3c: Perceived Stress, Emotional Intelligence, and QOL. Perceived stress was hypothesized to mediate the relationship between EI and QOL. Preliminary analyses indicated that the total score for T1 EI significantly predicted change in breast cancer specific QOL, and marginally predicted change in emotional QOL above and beyond demographics. However, perceived stress (all scales of IES at all timepoints) was unrelated to EI, and therefore no further steps in the mediational analyses were conducted. See Table 10 on page 49 for the results of these analyses.

Table 10. *EI Predicting QOL Change Scores*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
Breast Cancer Specific QOL Change Score					
1. Age				.22	
Race	.26	.26	3.19*	-.29	
2. EI (TMMS total)	.40	.14	3.82*	.38*	
					$F(3,20)=3.73$*
Emotional QOL Change Score					
1. Age				.10	
Race	.01	.01	.06	.06	
2. EI (TMMS total)	.16	.17	3.16+	.41+	
					$F(3,20)=3.13$+

Note: + = $p = .09$; * = $p < .05$

Hypothesis 4: Differential Changes in Cognitive and Somatic Anxiety as a Function of Intervention Group

Finally, the fourth hypothesis evaluated whether there were differential changes in cognitive and somatic anxiety, based on whether participants took part in the TCH or SG group. Therefore, a 2 (intervention groups) x 2 (Time: pre-post) ANOVA was conducted with cognitive and somatic anxiety as the dependent variables. Unfortunately the numbers for these analyses were extremely low (n=5). When evaluating cognitive anxiety as the DV, results were not significant for either the main effect of time: [F (1,5)=.08, p=.82, Wilk's Lambda=.92, partial eta squared=.92] or for the interaction of group x time: [F(1,5)=1.34, p=.26, Wilk's Lambda=.43, partial eta squared=.57]. With somatic anxiety as the DV, results also were not significant for either the main effect of time [F

(1,5)=16.3, p=.15, Wilk's Lambda=.06, partial eta squared=.94], or for the interaction of group x time [$F(1,5)=8.33$, $p=.21$, Wilk's Lambda=.11, partial eta squared=.89]. Both of these analyses were underpowered. However, the means were in the appropriate predicted direction.

Table 11. *Means of Cognitive and Somatic Anxiety by Intervention Group*

	TCH (n=3)	SG (n=2)
T1 Cog. Anxiety	16	17
T2 Cog Anxiety	19	12
T1 Som. Anxiety	45	47.5
T2 Som Anxiety	26	41

Supplementary Analyses:

Three sets of supplementary exploratory analyses were conducted which did not directly address a priori formulated hypotheses. The first of these presents available data on immunological variables and evaluates relationships with available data on outcome measures. The other two consist of follow-up analyses assessing the impact of each of two dispositional variables (monitoring attentional style and emotional intelligence respectively) as moderators of the effects of intervention groups on quality of life.

Immunological Variables. Because only T1 data were available for the cytokines, no change scores were able to be computed. Therefore, using T1 cytokine data, a series of correlational analyses were conducted with the cytokines and each outcome variable. Mean values of each immune variable are reported in Table 12 on page 51. Mean values are reported as absolute values, whereas all correlational analyses were conducted using log transformations of these values. Many biological variables do not meet the assumptions of parametric statistical tests because they are not normally distributed, the

variances are not homogeneous, or both. Therefore, log transforming these data are common practice to prevent these problems (McDonald, 2006).

Table 12. *Mean Absolute Values (pg/ml) and Ranges of Cytokines at Time 1*

Cytokine	Mean	*n*	*SD*	Min.	Max.
IL-12	275.66	21	893.75	.64	4155.90
IL-10	30.11	26	119.54	.66	614.68
IL-6	41.16	6	36.84	2.92	102.24
IL-4	34.49	18	57.62	4.94	256.23
IL-2	421.69	5	199.23	223.38	741.37
IL-1β	2.34	12	3.58	.03	11.60
TNF-α	20.73	9	31.64	1.76	102.37
IFN-γ	170.50	12	184.36	16.09	669.37

Table 13. *Significant Correlations Between Immune and Other Variables at Baseline.*

Cytokines:	**Type I**				**Type II**
Measures:	IL-1β	IL-2	TNF-α	IFN-γ	IL-10
IL-12	-	-	-	-	.71**
IL-4	.70*	-	-	.74*	-
Optimism	-	-	.94*	-	.58*
Total Anxiety	-	-	-.74*	-	-
Somatic Anxiety	-	-	-.90**	-	-
POMS Vigor	-	-	.72*	-	-
Social QOL	-	.99*	-	-	-
WAYS Positive Reappraisal	-	-	-	.71*	-
WAYS Confrontive Coping	-.85**	-	-	-	-

* = $p < .05$, ** = $p < .01$

Attentional Style, Intervention Group, and QOL

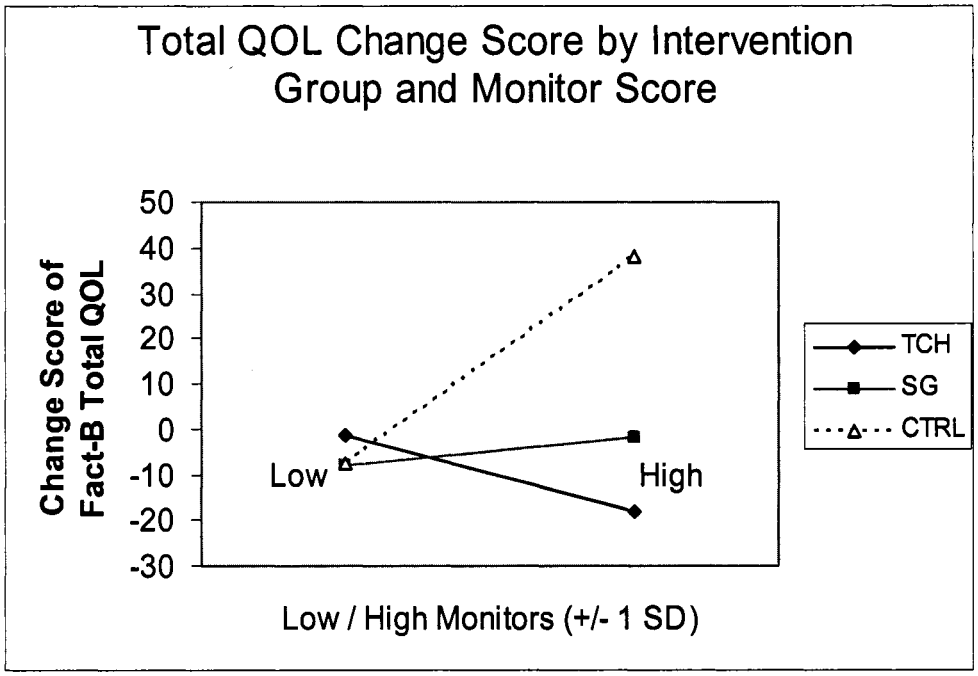
Because attentional style (specifically the monitor scale) was found to be a significant predictor of change in breast cancer specific QOL and total QOL (see Table 9, p. 48; under Hypothesis 3c) additional analyses were conducted to evaluate whether monitoring and intervention group interacted to account for changes in QOL scores. Significant results emerged for the FACT-B Total QOL change score. The results are reported below.

Results from the interaction between monitors and intervention group were plotted on a graph to visually display change scores in total QOL with monitors (+/- 1 SD) and intervention group. See Figure 3 on page 53 for the visual depiction.

Table 14. *Monitors x Intervention Group and Total QOL Change Score*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
1. Age				.38	
Race	.07	.07	.52	.01	
2. Monitor Score	.08	.01	.07	-1.05	
3. Intervention	.22	.15	2.28	-2.13	
4. Monitor x Intervention	.47	.25	5.23*	2.33*	
					$F(5,16)=3.25$*

Note: * = $p < .05$; + = p=.06



*note: positive change scores represent and increase, negative change scores represent a decrease

Figure 3. Interaction Between Intervention Group Designation and Monitoring Score

These analyses indicated that those who were low monitors in all three intervention groups had slight decreases in total QOL, and about the same amount of change. However, those who were high monitors showed differential changes by the intervention group they were in. Those who were high monitors in the CTRL group had the greatest increases in total QOL, whereas monitors in the TCH group showed the greatest decreases in total QOL. High monitors in the SG groups showed very little change in their total QOL.

Emotional Intelligence, Intervention Group, and QOL. Because EI significantly predicted change in breast cancer specific and emotional QOL above and beyond demographics, follow-up analyses were conducted to evaluate whether there was an interaction between EI and intervention group designation for QOL. No significant interaction emerged with breast cancer specific QOL, but significant main effect results emerged for emotional QOL, and results are presented below in Table 15.

Table 15. *Interaction of EI (TMMS Total) x Intervention Group in Predicting Emotional QOL Change Score*

Step and Variable	R^2	ΔR^2	ΔF	β	Overall F
1. Age				.26	
Race	.01	.01	.06	.25	
2. EI	.16	.16	3.16+	.16+	
3. Intervention Group	.38	.22	5.59*	1.57*	
4. EI x Intervention	.40	.02	.56	1.12	
					$F(2,20)=2.14+$

Note: + = p=.09, *=p<.05

Results from these analyses indicated that there were main effects for emotional intelligence (marginally significant) and for intervention group in predicting the change

score for emotional QOL. The interaction between EI and intervention group was not significant. The significant main effects reflected the fact that those with higher levels of EI and those in the CTRL group showed the greatest increases in QOL.

CHAPTER V

Discussion

The purpose of this study was to evaluate the relationships between selected psychosocial and immunological variables in a sub-sample of 40 women with breast cancer enrolled in a larger NCI-funded trial. The current study evaluated the role of dispositional (optimism, attentional style, and emotional intelligence), state (perceived stress, mood, coping), and immunological (Type I and II cytokines) variables in relation to each other using a prospective longitudinal design. These women were assessed before beginning chemotherapy, and again 10 weeks later.

In the present study, race was associated with differences in coping. Compared to African Americans, Caucasian participants reported more frequently using coping in the domains of seeking social support and planful problem solving. There is a large body of literature supporting racial differences in coping styles, and an emerging body of literature evaluating these differences in ill populations. For instance, in a study of 333 persons with kidney transplants, racial differences emerged in the coping patterns of acceptance, humor, religion, denial, and behavioral disengagement (Lunsford et al., 2006).

Women in this study reported levels of depression, anxiety, and perceived stress that were not significantly elevated (see means in Table 1). Mean scores for depressive symptoms as measured by the CESD (T1 mean = 13.16, T2 mean = 12.71) were slightly lower than a previously studied sample of 96 women with breast cancer who were receiving chemotherapy (Badger et al., 2007; mean = 14.73). Our participants' CESD

means were also significantly lower than a previously published sample of 205 heterogeneous cancer patients newly diagnosed (Brown, Levy, Rosberger, & Edgar, 2003; mean = 20.8). Clinically significant levels of depressive symptoms are indicated by CESD scores > 16. Therefore, our sample reported subclinical levels of depressive symptoms at baseline and while undergoing chemotherapy treatment.

Early research on breast cancer suggested that severe emotional reactions such as depression, anxiety, and anger were the "norm" in this group (Meyerowitz, 1980; Miller, 1980). However, more recent studies paint a more positive picture, finding that women with no prior psychiatric disorder are unlikely to develop severe psychological symptoms (Antoni et al., 2001; Epping-Jordan et al., 1999; Ah, Khang, & Carpenter, 2007; Schmidt & Andrykowski, 2004). Although recent studies suggest that emotional responses may not be as severe as indicated in prior research, this should not obscure the fact that the experience of having cancer remains a major stressor.

Patterns of coping (as measured by WAYS) in this study were similar to those reported in other studies of women with early-stage breast cancer. The most frequently used coping patterns participants reported using at both T1 and T2 were seeking social support and positive reappraisal. The patterns least frequently used were accepting responsibility and confrontive coping. In Carver et al.'s 1993 study, using a different coping measure (COPE), investigators found seeking social support and positive framing to be the most prominently reported coping styles in a population of early-stage breast cancer patients at the same stage of treatment as the current sample. It certainly would be expected that women with a new diagnosis of breast cancer and functional losses would

benefit most from social support and positive reappraisal. It also is appropriate that when faced with this specific stressor, confrontational coping and accepting responsibility would not produce beneficial outcomes and, thus, would be used less frequently if women were coping effectively.

Effects of Interventions

Analyses evaluating the effect of the interventions on measures of mood and QOL revealed interesting, and somewhat contradictory findings. First, on the total mood disturbance scale of the POMS, scores increased less in the TCH group, whereas a greater increase was reported from those in the CTRL group. These findings suggest that the TCH intervention was marginally effective at buffering the impact of mood disturbance symptoms, as measured by the POMS. To our knowledge, no previous studies evaluating TCH in women newly diagnosed with breast cancer have been reported, however some studies have found similar results in other populations. For example, in a randomized, controlled trial of 38 individuals with HIV, Galantino et al., (2005) reported significant reductions on POMS subscales. Specifically, they found that those in the TCH group, relative to CTRLs had improved scores on tension/anxiety and confusion/bewilderment subscales of the POMS, as well as overall QOL. In a study of 18 traumatic brain injury patients, Gemmel et al (2006) found that participants in the TCH group relative to CTRLs showed decreases in sadness, confusion, anger, tension, fear and increases in energy and happiness. In a group of 20 patients with rheumatoid arthritis (Wang, 2005), those in the TCH group, relative to CTRLs showed significant reductions on anxiety and depression measures (CESD, HAQ). In 30 patients with heart failure, Yeh et al (2004) found that

those in the TCH group reported significant improvement in QOL. These few randomized, controlled trials, taken together, suggest that TCH is effective for reducing mood symptoms, similar to our finding of reductions in the POMS total mood disturbance score. However, as Lee, Pittler and Ernst (2007) suggest in their review of TCH for cancer patients, the literature is very limited, and most trials suffered from methodological flaws such as small sample size, inadequate study design and poor reporting. Therefore, the evidence is not convincing enough to suggest that tai chi is an effective supportive treatment for cancer patients. Additionally, unfortunately a publication bias (the "file drawer" phenomenon) precludes us from including the unpublished studies that likely did not find significant results.

When evaluating the effect of the interventions on depressive symptoms, as measured by the CESD, those in the CTRL group showed the greatest decrease, followed by those in the SG group, while those in the TCH group showed a slight increase. These findings are not consistent with our above mentioned findings or those reported in the literature. It should be noted that although not *significantly* different at baseline, those in the CTRL group had much higher CESD scores to begin with, and their change may simply in part be function of regression toward the mean. When evaluating the effects on functional QOL, those in the CTRL group also showed the greatest improvement, which is inconsistent with the above mentioned studies including QOL measures.

Overall, these results suggest that the TCH intervention was effective for total mood disturbance relative to the CTRL group, but otherwise the CTRL group showed the most improvement on depressive symptoms and functional QOL. Of course these data

were not what we anticipated, and a logical explanation based on the extant literature is very difficult to support. However, considering that our number of participants in each group was extremely small (n = 2-3), it is very possible that these results emerged as chance findings from such a small population and will not prove to be reliable when cross-validated on larger samples. It is also possible that through a group experience and discussion with others going through the same experience, the women in the intervention groups became more acutely aware of their symptoms, and thus reported more symptoms. Further research should attempt to answer the many open questions related to the usefulness of TCH and SG groups for supportive cancer care.

Dispositional Predictors

The dispositional variables of interest to this study, optimism, attentional style, and emotional intelligence were hypothesized to differentially predict change in outcomes. We found significant results regardless of intervention, and some significant interactions between predictors and intervention groups. Although several sets of our analyses were underpowered, some significant results still emerged. This has the potential for two implications, either that they occurred by chance in such a small population, or that they occurred in such a small population, and thus are very robust. Although none of our original mediational analyses were significant, other interesting main effect relationships were revealed.

Optimism and Immune Functioning. Although T2 data were not available for the cytokine data, and change scores were thus not able to be computed, interesting results emerged at T1. Our analyses revealed that optimism accounted for 93% of the variance in

TNF-α levels at T1, above and beyond variance accounted for by age and race. Although significant correlations emerged for optimism and IL-10, regression analyses after first accounting for the influence of demographics, did not reveal any significant contribution of optimism in accounting for variance in IL-10 levels.

In the current study, optimism was not significantly correlated with other variables that are often thought to be similar. For instance, optimism was not significantly correlated with benefit finding or mood repair. Levels of optimism in this sample were higher than those reported in other studies of women with early-stage breast cancer at the same stage of treatment (Ah, Kang, & Carpenter; 2007; Antoni et al., 1998; Epping-Jordan et al., 1999).

Some researchers have found in healthy individuals that optimism is associated with higher immune parameters including higher cytotoxic T-lymphocyte numbers and natural killer cell activity (Byrnes et al., 1998; Cohen et al., 1999; Segerstrom et al., 1998), suggesting that optimism may buffer stress-induced immune alterations. Among law students, optimism was associated with better mood, higher numbers of helper T lymphocytes, and higher natural killer cell cytotoxicity (Segerstrom et al., 1998). In a sample of 54 women newly diagnosed with breast cancer, optimism moderated the relationship of stress on natural killer cell activity but was not related to IFN-γ levels (Ah, Khang, & Carpenter, 2007).

Although several reports link higher levels of TNF-α and IL-10 to depressive symptoms, TNF-α is also known to be essential in the acute response to infection. Additional beneficial functions of TNF-α include its role in the immune response to

bacterial, and certain fungal, viral, and parasitic invasions, as well as its role in the necrosis of specific tumors. Further, it acts as a key mediator in the local inflammatory immune response. TNF-α is involved in the acute phase response, initiating a cascade of cytokines and increased vascular permeability, thereby enhancing recruitment of macrophages and neutrophils to a site of infection. Therefore, in a sample of women who recently underwent surgery and are preparing for chemotherapy, a higher level of TNF-α would indicate an adaptive response. Thus, in our sample, we concluded that higher levels of optimism were associated with improved immune function. Further discussion on the role of cytokines in this population follows in the "Immunological Correlates" discussion section (p. 66).

Attentional Style. Although our original hypothesis that blunting would predict reduction in anxiety was not significant, monitoring was a marginally significant predictor of anxiety reductions, after accounting for age and race. The demographics accounted for 72% of the variance in anxiety reductions, and beyond that, monitoring accounted for an additional 25% of the variance in anxiety reductions. These results indicated that those who reported higher levels of baseline monitoring reported greater reductions in anxiety. This finding is somewhat inconsistent with previous work on attentional style in a cancer population.

Monitor levels were also found to be significant predictors of increases in QOL. For changes in breast cancer specific QOL, monitoring scores accounted for 20% of the variance above and beyond demographics. For changes in total QOL, monitoring scores accounted for 34% of the variance above and beyond demographics. These results

indicated that those who had higher monitoring scores, showed the most improvements in both breast cancer specific, as well as total QOL.

Additionally, a significant monitoring score by intervention group interaction emerged, accounting for 25% of the variance for change in total QOL. Those who were low monitors in all three intervention groups had decreases in their QOL. However high monitors showed differential changes by intervention group. With high monitors, the greatest benefit in total QOL emerged for those in the CTRL group, then SG, followed by the TCH group.

Although no previous studies, to our knowledge, have reported relationships between QOL and attentional style, numerous studies have reported differential distress levels in persons differing in attentional style. In the medical setting, this has generally manifested as a heightened sense of risk. Monitors have consistently been shown to exhibit higher levels of distress compared to blunters (Miller, Knowles, Schnoll & Buzaglo, 2002). Miller et al. (2001) have reported that in general, monitors manifest more psychological distress in response to cancer threats. In the context of cancer treatment, patients undergoing chemotherapy who were characterized as monitors were more likely than blunters to report greater anxiety prior to treatment, higher levels of depression during administration of chemotherapy, and greater and more prolonged symptoms of nausea (Gard, Edwards, Harris & McCormack, 1988; Lerman et al., 1990).

However, distress can be minimized for monitors under situations of threat if they receive voluminous information that reduces the uncertainty and unpredictability of the situation and increases their sense of perceived control (Miller, 1995, 1996). Monitors

facing aversive medical situations have been shown to manage better emotionally, physiologically, and behaviorally when detailed procedural and sensory information is available (Gattuso et al., 1992; Miller & Mangan, 1983; Watkins, Weaver, & Odegaard, 1986). We have no knowledge of how much information our participants acquired on their own regarding their diagnosis and treatment. Although the interventions did not address any informational or educational components, it is quite possible that these participants acquired this information on their own or from their physicians and nurses, and thus fared better. With the modern technology available to most everyone, patients now are able to access as much information as they desire, even if healthcare professionals do not provide it.

Monitors actively seek out, amplify, and focus on threatening aspects of health-related information (Miller, 1996; Miller, Combs & Kruus, 1993). Although monitoring levels, in general, have been associated with more distress in cancer patients (Miller, 2001), other related concepts have been associated with better psychological well-being. For instance, attention, care, focus on managing cancer demands, active coping, response-focused self-regulatory coping, and fighting spirit have all been associated with higher levels of psychological well-being (Miller & Schnoll, 2000).

Emotional Intelligence. Higher levels of EI were hypothesized to be associated with lower stress levels. This hypothesis was not supported in our study, as there were no significant associations found between baseline EI and stress. In the Schmidt and Andrykowski (2004) study with 210 women (who were an average of 22.6 months post-diagnosis), the authors found significant relationships between EI and distress. Of

importance to the current study, they found EI (total score) to be a significant predictor of lower levels of depression, anxiety, and IES-avoidance scores. None of these findings were replicated in our study.

However, EI was found to be a significant predictor of change in breast cancer QOL, and a marginally significant predictor of change in emotional QOL above and beyond demographics. Specifically, those who reported higher EI showed the most improvement over time in both domains of QOL. Additionally, a marginally significant main effect emerged for intervention group in predicting emotional QOL. These results indicated those were in the CTRL group had the greatest increases in emotional QOL.

Although Schmidt and Andrykowski (2004) did not measure QOL, and we did not find significant results for the same measures that they did, it seems logical based on their findings that EI buffered against distress, that EI could also serve as a predictor of improved QOL. Only one other published study reported relationships between EI and QOL. Extremera and Fernandez-Berrocal (2002) found that healthy middle-aged women who reported higher levels of EI also reported higher levels of health-related QOL.

Although there were no significant mediational results associated with EI, that may simply be a result of being underpowered from a small number of participants in these analyses. Again, this finding gives us promise for future research in this population with a larger number of participants.

Cognitive and Somatic Anxiety

Although the differential effects of the interventions on cognitive and somatic anxiety were not significant, the means of each of these domains split differently and

were in the appropriate hypothesized direction. Those in the TCH group showed the greatest reductions in somatic anxiety, whereas those in the SG groups showed the greatest reductions in cognitive anxiety. These analyses were clearly underpowered, and future analyses with more participants show promise. Some previous findings have suggested that cognitive procedures such as those with a spiritual focus are most effective for cognitive anxiety, whereas somatic procedures such as TCH are most effective for somatic anxiety (Davidson & Schwartz, 1976; Rausch, Gramling & Auerbach, 2006). It is possible that it may be therapeutically beneficial to match the particular relaxation intervention with the type of anxiety or stress present in an individual. For instance, individuals with somatic anxiety may benefit more from a somatic technique such as TCH, whereas individuals with cognitive anxiety may benefit more from a cognitive technique such as SG, meditation, or cognitive therapy. Although no definitive conclusions can be made from the current study since results were not significant, the means of each of these subscales of anxiety went in the same direction as hypothesized based on this literature.

Immune Correlates. Overall, the significant correlations between the reported cytokines and psychological variables indicated that more positive mood states were associated with higher levels of both Type I and II cytokines, whereas negative mood states were associated with lower levels of cytokines. The only Type II cytokine that was associated with psychological variables was IL-10. As previously noted, higher levels of optimism were associated with higher levels of IL-10. As for the Type 1 cytokines, we found higher levels of TNF-α were associated with lower levels of distress-related

variables (total anxiety, somatic anxiety, fatigue), and higher levels of optimism. Higher levels of IL-2 were associated with higher levels of the social component of QOL. Higher levels of positive reappraisal coping were associated with higher levels of IFN-γ, and higher levels of confrontive coping were associated with lower levels if IL-1β.

These results indicate that overall less distress and fatigue, positive mood, and positive cognitive coping were associated with higher levels of Type I cytokines in this sample. Because the body of research on mood and cytokines is extremely limited, these results are presented simply as exploratory at this time.

In the psychoneuroimmunology literature, social variables have been reliably and positively associated with immunity (Uchino et al., 1996). Immune functioning has been linked to a number of psychosocial variables in healthy samples (Gerits & De Brabander, 1999). Similarly, among cancer patients previous authors have found higher levels of perceived social support to be associated with higher levels of natural killer cell activity (Levy et al., 1990) and white blood cell counts (Lekander et al., 1996).

Like natural killer cells, cytokines are important immune factors. These soluble mediator molecules induce, enhance, or effect immune responses (Dranoff, 2004). Proinflammatory cytokines such as TNF-α have well-known cytotoxic effects on human breast cancer cells (Weitsman et al., 2003, 2004). Unfortunately, the blood cells of breast cancer patients are thought to have impaired ability to produce TNF-α (Zielinski et al., 1990, 2003). Therefore, other authors have noted that in patients with breast cancer, initial elevated levels of Type 1 cytokines represent a good immunological response (Marucha et al., 2005).

Of the few studies investigating the role of cytokines and psychological states, inconsistent results have emerged, with the exception of the role of depression and proinflammatory cytokines. Previous studies have clearly linked increased proinflammatory cytokines with depressive symptoms (Maes, Smith, & Scharpe, 1995).

Most frequently presented in the literature are findings related to the relationship between depressive symptoms and IL-6. However, in the current study, we found no significant relationships between IL-6 and other variables. Other authors also report significant relationships between other proinflammatory cytokines (IL-1, TNF-α) and depression (Besedovsky, 1996; Blalock, 1989; Reichlin, 1993), but we found no significant relationships between depressive symptoms (CESD or POMS) and any of the immunological variables.

Of relevance to mood disorders, cytokines associated with depression can also induce "sickness behavior," which includes symptoms of fatigue, anorexia, anhedonia, decreased psychomotor activity, and decreased body-care activities (Kent et al., 1992; Yirmiya, 1996). Contrary to previously reported findings, we found a positive relationship between TNF-α and POMS vigor, an indicator of energy. However, it may be that the fatigue and sickness behavior related to IL-6 and other inflammatory cytokines is specific to depressive-related fatigue. It also may be the case that because the women in this sample reported subclinical levels of depression, these relationships did not emerge.

In experimental animals there are some reports which show that psychological

stress elevates plasma IL-6 levels and induces the hypothalamic expression of IL-1 (LeMay, Vander, Luger, 1990; Zhou, Kusnecov, Shurin, DePaoli, Rabin, 1993; Minami, et al., 1991) . In a sample of 38 medical students (Maes et al., 1998), increased psychological stress was associated with higher levels of TNF- α, IL-6, IL-1, IFN-γ, and IL-10. Students with higher levels of anxiety reported higher levels of IFN-γ and lower levels of IL-10 and IL-4. Overall, psychological stress (as measured by anxiety and perceived stress) was accompanied by increased proinflammatory cytokines in that student sample. The authors further suggested that psychological stress could be perceived by the immune system, and through the secretion of proinflammatory cytokines, take part in an integrated anticipatory psychoneuoimmunological response aimed at preparing the organism to cope with stressors. Therefore, this response could serve as an adaptation to the psychological impact of stress.

It was interesting that of the cytokines significantly related to other variables, levels were all in the same direction (higher levels of all cytokines were related to positive outcomes). Taking into account previous studies in cancer patients that indicate higher levels of proinflammatory cytokines are an adaptive response, it is understandable that our results were different than those in healthy populations. Of course these complex relationships are not identified or clear in the context of the present study and warrant future research.

Summary. In summary, despite methodological problems that emerged related to data collection and a smaller number of participants than anticipated, significant results emerged. Differential effects of the two interventions were observed. First, TCH was

shown to act as buffer in total mood disturbance scores. Interestingly, those in the CTRL group showed the largest decrease in depressive symptoms, and increase in functional QOL. The dispositional predictors of interest to this study showed predictive value, both regardless of intervention group, and interacting with the intervention groups. Optimism was a significant predictor of TNF-α, monitoring was a significant predictor of changes in anxiety (marginally), breast cancer specific QOL, and total QOL. A significant interaction emerged with monitors and intervention group in predicting changes in total QOL. EI was a significant predictor of breast cancer specific QOL, a marginally significant predictor of emotional QOL, and a marginal main effect also emerged with those in the CTRL group showing more increases in emotional QOL. These results offer great promise as we continue this line of research in the same population, and aim to cross-validate our findings with a larger sample. We plan to continue to evaluate these relationships throughout the duration of the larger study with a larger number of participants. Therefore, our hope is that some of these relationships will become clearer, and complex analyses (e.g., mediational relationships) will be able to be analyzed with sufficient power. The prospect of revealing relationships between dispositional predictors and psychoneuroimmunological outcomes also offers great promise to intervention.

Strengths and Limitations

Major strengths of the current study are the holistic approach inherent to the PNI framework and derivation of the study from a solid theoretical and empirical background.

The measures added to the larger study (optimism, attentional style, EI, anxiety, and mood) and analyses added knowledge of psychosocial mechanisms to the existing biobehavioral measures, enabling a comprehensive look at potential mechanisms underlying the selected CAM interventions.

This study added unique value to the larger study by investigating the role of dispositional and situational measures as well as potential mediational paths. Understanding the psychosocial mechanisms of action responsible for change in these interventions is of utmost importance (NCCAM, 2004), and the current work will provide an assessment of these mechanisms. Stress management interventions have shown to be valuable for breast cancer patients. Results from this research could improve the value of these interventions by helping to determine how they work, and identifying which patients would be best helped by which interventions.

Another aspect of further study will include the relationship of urinary cortisol levels to the psychosocial and immunological variables. Cortisol is well established as a mediational pathway between stress and immune status, so this component will also add valuable information to these findings.

Another limitation of the current study is in the limited demographic and cofactors included in analyses. Previous studies have shown that demographic variables such as marital status, socioeconomic status, education, religious affiliation, current medications, behavioral health factors could all be factors contributing to study findings. Although some studies have shown that treatment-related variables such as type of surgery and treatment order (radiation vs. chemotherapy first) do not contribute to

distress symptoms (Epping-Jordan et al., 1999), critical disease and prognostic indicators such as menopausal status; hormone replacement history; tumor pathologic characteristics of grade, estrogen/progesterone receptor protein status, and number of positive nodes; as well as type of surgery (lumpectomy vs. mastectomy) could also contribute to outcomes (Simpson et al., 2000). Given the small sample size and exploratory nature of this study, these variables were not included in analyses. However, in the future these factors will be evaluated through multivariate analyses.

As mentioned by other authors investigating distress in women with early-stage breast cancer, women generally have a very good prognosis if being treated for early-stage disease. The distress levels women report reflect the experience of a crisis that, over-all, is being handled relatively well. Therefore, the full relationship between stress levels and immunological factors may be somewhat limited, but are typical of research in breast cancer (Irvine et al., 1991). Although distress levels for this specific population were not significantly elevated, they should not be discounted in evaluating the generality of findings. For instance, we can not conclude that findings from this study would extend to patients with advanced cancers. In the same fashion, we can not conclude that this pattern of findings would generalize to any other population experiencing stressors of comparable severity. Examining that question will be an important task for future research.

At this time, the relationship between psychosocial factors and incidence as well as mortality in cancer has not been determined. Although it remains speculative, research is continuing in the direction of identifying psychological states that in turn predict

physiological outcomes, such as immune function. To date, no studies are available that provide insight into the relationship between psychosocial factors on the one hand and immune function and disease progression on the other. However, the future and promise of this research remains bright, and therefore will continue to be conducted. Intervention studies are well underway to assess whether changing some identified mood states may also, in turn, predict better immune or disease outcomes.

References

Adler, P., Good, M., Roberts, B. & Snyder, S. (2000). Effects of Tai Chi on older adults with chronic arthritis pain. *Journal of Nursing Scholarship, 32,*7-10.

Ah, D.V., Kang, D.H. & Carpenter, J.S. (2007). Stress, optimism, and social support: Impact on immune responses in breast cancer. *Research in Nursing and Health, 30,* 72-83.

American Cancer Society, (ACS; 2004). Breast Cancer Facts & Figures 2003-2004. Retrieved November 10, 2004, from http://www.cancer.org/downloads/STT/CAFF2003BrFPWSecured.pdf.

Andersen, B.L. (1992). Psychological interventions for cancer patients to enhance the quality of life. *Journal of Consulting and Clinical Psychology, 60,* 552-568.

Andersen, B.L. (2002). Biobehavioral outcomes following psychological interventions for cancer patients. *Journal of Consulting and Clinical Psychology, 70,* 590-610.

Antoni, M.H., Lehman, J.M., Kilbourn, K.M., Boyers, A.E., Culver, J.L., Alferi, S.M., Yount, S.E., McGregor, B.A., Arena, P.L., Harris, S.D., Price, A.A., & Carver, C.S. (2001). Cognitive-behavioral stress management intervention decreases the prevalence of depression and enhances benefit finding among women under treatment for early-stage breast cancer. *Health Psychology, 20,* 20-32.

Badger, T., Segrin, C., Dorros, S.M., Meek, P., & Lopez, A.M. (2007). Depression and anxiety in women with breast cancer and their partners. *Nursing Research, 56,* 44-53.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Beaulac, S.M., McNair, L.A., Scott, T.E., LaMorte, W.W., & Kavanah, M.T. (2002). Lymphedema and quality of life in survivors of early-stage breast cancer. *Archives of Surgery, 11,* 1253-1257.

Benson, H., (1975). *The Relaxation Response.* New York: Morrow.

Ben-Zur, H., Gilbar, O., & Lev, S. (2001). Coping with breast cacner: Patient, spouse, and dyad models. *Psychosomatic Medicine, 63*(1), 32-39.

Bernstein, B.J., & Grasso, T. (2001). Prevalence of complementary and alternative medicine use in cancer patients. *Oncology, 15,* 10, 1267-1272.

Besedovsky, H.O., Herberman, R.B., Temoshok, L.R., & Sendo, F. (1996). Psychoneuroimmunology and cancer: fifteenth Sapporo Cancer Seminar. *Cancer Research, 56,* 4278-4281.

Bhatti, T.I., Gillin, J.C., & Atkinson, J.H. (1998). T'ai Chi Chih as a treatment for chronic low back pain: a randomized, controlled study. Proceedings of the Third Annual Alternative Therapies Symposium Creating Integrated Healthcare, San Diego, April, 1998. *American Association of Critical Care Nursing, 7,* 216-218.

Biondi, M. (2001). Effects of stress on immune functions: An overview . In R. Ader, D.L. Felton, & N. Cohen (Eds.), *Psychoneuroimmunology* (3rd ed., Vol 1) (pp.189-226). San Diego: Academic Press.

Blalock, J. (1989). A molecular basis for bi-directional communication between the immune and neuroendocrine system. Physiological. Reviews, *69,* 1-32.

Bottomley, J.M. (2000). The use of tai chi as a movement modality in orthopedics. *Orthopedic and Physical Therapy in North America, 9,* 361-373.

Bridge, L.R., Benson, P., Pietroni, P.C., & Priest, R.G. (1988). Relaxation and imagery in the treatment of breast cancer. *British Medical Journal, 297,*(6657):1169-72.

Brown, K.W., Levy, A.R., Rosberger, Z., & Edgar, L. (2003). Psychological distress and cancer survival: A follow-up 10 years after diagnosis. *Psychosomatic Medicine, 65,* 636-643.

Byrnes, D.M., Antoni, M.H., Goodkin, K., Efantis-Potter, J., Asthana, D., Simon, T., Manajj, J., Ironson, G., & Fletcher, M.A. (1998). Stressful events, pessimism, natural killer cell cytotoxicity, and cytotoxic/suppressor T cells in HIV+ Black women at risk for cervical cancer. *Psychosomatic Medicine. 60*, 714–722.

Carlson, L.E., Speca, M., Patel, K.D., & Goodey, E. (2003). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. *Psychosomatic Medicine, 65,* 571-581.

Carver, C.S., Lehman, J.M., & Antoni, M. (2003). Dispositional pessimism predicts illness-related disruption of social and recreational activities among breast cancer patients. *Journal of Personality and Social Psychology, 84,* 813-21.

Carver, C.S., Pozo, C., Harris, S.D., Noriega, V., Scheier, M., Robinson, D.S., Ketcham, A.S., Moffat, F.L., and Clark, K.C. (1993). How coping mediates the effect of optimism on distress: A study of women with early stage breast cancer. *Journal of Personality and Social Psychology, 65,* 2, 375-390

Carver, C.S., & Scheier, M.F. (1994). Situational coping and coping dispositions in a stressful transaction. *Journal of Personality and Social Psychology, 66,* 184-195.

Cella, D.F., Tulsky, D.F., Gray, G., Sarafian, B., Linn, E., Bonomi, A., Silberman, M., Yellen, S.B., Winicour, P., & Brannon, J. (1993). The Functional Assessment of Cancer Therapy scale: development and validation of the general measure. *Journal of Clinical Oncology, 11*, 570-579.

Channer, K.S.Barrow, D., Barrow, R., Osborner, M., & Ives, G. (1996). Changes in haemodynamic parameters following Tai Chi Chuan and aerobic exercise in patients recovering from acute myocardial infarction. *Postgraduate Medicine Journal, 72,* 349-351.

Chen, K., & Snyder, M. (1999). A research-based use of Tai Chi/movement therapy as a nursing intervention. *Journal of Holistic Nursing, 17,* 267-279.

Christensen, L. (1996). Psychological mechanisms underlying the effects of carbohydrates on depression. *Diet-behavior relationships: Focus on depression. (pp. 55-69).* Washington, DC, US: American Psychological Association.

Cohen, R.S., Boston, P., Mount, B.M., & Porterfield, P. (2001). Changes in quality of life following admission to palliative care units. *Palliative Medicine, 15,* 363-371.

Cohen, F., Kearney, K.A., Zegans, L.S., Kemeny, M.E., Neuhaus, J.M., & Stites, D.P. (1999). Differential immune system changes with acute and persistent stress for optimists vs. pessimists. *Brain, Behavior, and Immunity, 13,* 155–174.

Compas,B.E., Stoll, M.F., Thomsen, A.H., Oppedisano, G., Epping-Jordan, J.E., & Krag, D.N. (1999). Adjustment to breast cancer: age-related differences in coping and emotional distress. *Breast Cancer Research and Treatment, 54,* 195-203.

Cooper, C.L. (1984). The social-psychological precursors to cancer. *Journal of Human Stress, 10,* 4-11.

Cooper, C.L. (1988). A structural model approach toward the development of a theory of the link between stress and mental health. *British Journal of Medical Psychology, 61,* 87-102.

Coster, S., Poole, K., & Fallowfield, L.J. (2001). The validation of a quality of life scale to assess the impact of arm morbidity in breast cancer patients post-operatively. *Breast Cancer Research and treatment, 68,* 273-282.

Cruess, D.G., Antoni, M.H., McGregor, B.A., Kilbourn, K.M., Boyers, A.E., Alferi, S.M., Carver, C.S., & Kumar, M. (2000). Cognitive-behavioral stress management reduces serum cortisol by enhancing benefit finding among women being treated for early-stage breast cancer. *Psychosomatic Medicine, 62,* 304-308.

Devilly, G.J. (2005). Assessment devices. Retrieved May 26, 2006 from Swinburne University, Clinical & Forensic Psychology Web site: http://www.swin.edu.au/victims/resources/assessment/assessment.html.

Dhabar, F.S., & McEwen, B.S. (2001). Bi-directional effects of stress and glucocorticoid hormones on immune function: Possible explanations for paradoxical observations. In R. Ader, D.L. Felton, & N. Cohen (Eds.), *Psychoneuroimmunology* (3rd ed., Vol 2) (pp.301-338). San Diego: Academic Press.

Dranoff, G. (2004). Cytokines in cancer pathogenesis and cancer therapy. *National Reviews of Cancer, 4,* 11-22.

Epping-Jordan, J.E., Compas, B.E., Osowiecki, D.M., Oppedisano, G., Gerhardt, C., Primo, K., & Krag, D.N. (1999). Psychological adjustment in breast cancer: Process of emotional distress. *Health Psychology, 18,* 315-326.

Extremera N, Fernández-Berrocal P. (2002). Relation of perceived emotional intelligence and health-related quality of life of middle-aged women. *Psychological Reports, 91,* 47-51.

Fawzy, F.I., Cousins, N., Fawzy N.W., Kemeny, M.E., Elashoff, R., & Morton, D. (1990). A structured psychiatric intervention for cancer patients. I. Changes over time in methods of coping and affective disturbance. *Archives of General Psychiatry, 47,* 720-725.

Fawzy, F.I., Fawzy, N.W., Hyun, C.S., Elashoff, R., Guthrie, D., & Fahey, J.L. (1993). Malignant melanoma: Effects of an early structured psychiatric intervention, coping, and affective state on recurrence and survival 6 years later. *Archives of General Psychiatry, 50,* 681-689.

Fawzy, F.I., Fawzy, N.W., Arndt, L.A., & Pasnau, R.O. (1995). Critical review of psychosocial interventions in cancer care. *Archives of General Psychiatry, 52,* 100-113.

Folkman, S. (1993). Psychological effects of HIV infection. In L. Goldberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (2nd ed.) (pp. 658-681). New York: Free Press.

Folkman, S., & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behavior, 21,* 219-234.

Fontana, J. (2000). The energy costs of a modified form of Tai Chi exercise. *Nursing Research, 49,* 91-96.

Fukui, S., Kamiya, M., Koike, M., Kugaya, A., Okamura, H., Nakanishi, T., Imoto, S., Kanagawa, K., & Uchitomi, Y. (2000). Applicability of a Western-developed psychosocial group intervention for Japanese patients with primary breast cancer. *Psychooncology, 9*(2), 169-177.

Galantino, M.L., Shepard, K., Krafft, L. (2005). The effect of group aerobic exercise and t'ai chi on functional outcomes and quality of life for persons living with acquired immunodeficiency syndrome. *Journal of Alternative and Complementary Medicine, 11,* 1085-92

Ganz, P.A., Coscarelli, A., Fred, C., Kahn, B., Polinsky, M.L., & Petersen, L. (1996). Breast cancer survivors: Psychosocial concerns and quality of life. *Breast Cancer Research and Treatment, 38,* 183-199.

Gard, D., Edwards, P.W., Harris, J., & McCormack, G. (1988). Sensitizing effects of pretreatment measures on cancer chemotherapy nausea and vomiting. *Journal of Consulting and Clinical Psychology, 56,* 80-84.

Gaston-Johansson, F., Fall-Dickson, J.M., Nanda, J., Ohly, K.V., Stillman, S., Krumm, S., & Kennedy, M.J. (2000). The effectiveness of the comprehensive coping strategy program on clinical outcomes in breast cancer autologous bone marrow transplantation. *Cancer Nursing, 23,* 277-285.

Gattuso, S.M., Litt, M.D., & Fitzgerald, T.E. (1992). Coping with gastrointestinal endoscopy: Self-efficacy enhancement and coping style. *Journal of Consulting and Clinical Psychology, 60,* 133-139.

Gemmell C & Leathem JM. (2006). A study investigating the effects of Tai Chi Chuan: individuals with traumatic brain injury compared to controls. *Brain Injury, 20,* 151-156.

Gerits, P., & De Brabander, B. (1999). Psychosocial predictors of psychological, neurochemical and immunological symptoms of acute stress among breast cancer patients. *Psychiatry Research, 1,* 95-103.

Glaser, R., & Kiecolt-Glaser, J. (1994). *Handbook of Human Stress and Immunity.* San Diego: Academic Press.

Greco, M., Agresti, R., Cascinelli, N., Casalini, P., Giovanazzi, R., Maucione, A., Tomasic, G., Ferraris, C., Ammatuna, M., Pilotti, S., & Menard, S. (2000). Breast cancer patients treated without axillary surgery: Clinical implications and biological analysis. *Annals of Surgery, 1,* 1-7.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research, 57,* 35-43.

Hartman, C.A., Manos, T.M., & Winter, C. (2000). Effect of t'chi training on function and quality of life indicators in older adults with osteoarthritis. *Journal of the American Geriatric Society, 48,* 1553-1559.

Heim, E., Augustiny, K.F., Schaffner, L., & Valach, L. (1993). Coping with breast cancer over time and situation. *Journal of Psychosomatic Research, 37*(5), 523-542.

Holland, J.C., & Rowland, J.H. (1987). *Handbook of Psycho-oncology: Psychological Care of the Patient with Cancer.* New York: Oxford University Press, 380-401.

Horowitz, M.,Wilner, N., & Alvarez, W. (1979). Impact of Events Scale: A measure of subjective stress. *Psychosomatic Medicine, 41,* 209-218.

Irvine, D., Brown, B., Crooks, D., Roberts, J., & Browne, G. (1991). Psychosocial adjustment in women with breast cancer. *Cancer, 67,* 1097-1117.

Irwin, M.R., Pike, J.L., Cole, J.C., & Oxman, M.N. (2003). Effects of a behavioral intervention, Tai Chi Chih, on varicella-zoster virus specific immunity and health functioning in older adults. *Psychosomatic Medicine, 65,* 824-830.

Jacobs, J.W., Bernhard, M.R., Delgado, A., & Strain, J.J. (1977). Screening for organic mental syndromes in the medically ill. *Annals of Internal Medicine, 86,* 40-46.

Jarrett, S.R., Ramirez, A.J., Richards, M.A., & Weinman, J. (1992). Measuring coping in breast cancer. *Journal of Psychosomatic Research, 36*(6), 593-602.

Jemal, A., Thomas, A., Murray, T., & Thun, M. (2002). Cancer statistics, 2002. *CA: Cancer Journal for Clinicians, 52,* 23-47.

Judd, C.M., & Kenny, C.A. (1981). Process analysis: Estimating mediation in evaluation research. *Evaluation Research, 5,* 602-619.

Karnofsky, D.A., Abelmann, W.H., Craver, L.F., and Burchenal, J.H. (1948). The use of the nitrogen mustards in the palliative treatment of carcinoma. *Cancer,* 634-656.

Kass, J.D., Friedman, R., Leserman, J., Zuttermeister, P.C., & Benson, H. (1991). Health outcomes and a new index of spiritual experience. *Journal of Science and Study of Religion, 30,* 203-211.

Kent, S., Bluthe, R.M., Kelley, K.W., & Dantzer, R. (1992). Sickness behavior as a new target for drug development. *Trends in Pharmacological Science, 13,* 24-28.

Kiecolt-Glaser, J. & Glaser, R. (1998). Commentary: Methodological issues in behavioral immunology research with humans. *Brain, Behavior, and Immunity, 2,* 67-78.

Kiecolt-Glaser, J., McGuire, L. Robles, T.F., and Glaser, R. (2002a) Psychoneuroimmunology: Psychological influences on immune function and health. *Journal of Consulting and Clinical Psychology, 70,* 537-547.

Kiecolt Glaser, J.K., Robles, T.F., Heffner, K.L., Loving, T.J., & Glaser, R. (2002b). Psycho-oncology and cancer: Psychoneuroimmunology and cancer. *European Society for Medical Oncology,10,*165-169.

Kiecolt-Glaser, J.K., McGuire, L., Robles, T.F., & Glaser, R. (2002). Psychoneuroimmunology and psychosomatic medicine: Back to the future. *Psychosomatic Medicine, 64,* 15, 15-28

Kinney, C.K., Rodgers, D.M., Nash, K.A., & Bray, C.O. (2003). Holistic healing for women with breast cancer through a mind, body, and spirit self-empowerment program. *Journal of Holistic Nursing, 21,* 260-279.

Kleine, P.J. & Adams, W.D. (2004). Comprehensive therapeutic benefits of taiji: A critical review. *American Journal of Physical Medicine and Rehabilitation, 83,* 9, 735-745.

Kogon, M.M., Biswas, A., Pearl, D., Carlson, R.W., & Spiegel, D. (1997). Effects of medical and psychotherapeutic treatment on the survival of women with metastatic breast carcinoma. *Cancer, 80,* 225-230.

Krag, D., Weaver, D., Ashikaga, T., Moffat, F., Klimberg, V.S., Shriver, C., Feldman, S., Kusminsky, R., Gadd, M., Kuhn, J., Harlow, S., & Beitsch, P. (1998). The sentinel node in breast cancer – A multicenter validation study. *New England Journal of Medicine, 14,* 941-946.

Lai, J-S., Wong, M-K., & Teng, S-H. (1995). Two year trends in cardiorespiratory function among older Tai Chi Chuan practitioners and sedentary subjects. *Journal of the American Geriatric Society, 43,* 1222-1227.

Lan, C., Lai, J-S., Wong, M-K.,Yu, M-L. (1996). Cardiorespiratory function, flexibility, and body composition among geriatric Tai Chi Chuan practitioners. *Archives of Physical Medicine and Rehabiliation, 77,* 612-616.

Lang, P.J., Bradley, M.M., & Cuthbert, B.N. (1999). International Affective Picture System (IAPS): Instruction manual and affective ratings. *Technical Report, A-4,* the Center for Research in Psychophysiology, University of Florida.

Larson, M.R., Duberstein, P.R., Talbot, N.L., Caldwell, C., & Moynihan, J.A. (2000). A presurgical psychosocial intervention for breast cancer patients. *Journal of Psychosomatic Research, 2,* 187-194.

Lechin, F., van der Dijs, B., Vitelli-Florez, G., Lechin-Baez, S., Azocar, J., Cabrera, A., Lechin, A., Jara, H., Lechin, M., Gomez, F., et al. (1990). Psychoneuroendocrinological and immunological parameters in cancer patients: involvement of stress and depression. *Psychoneuroendocrinology, 15,* 435-451.

Lee, M.S., Pittler, M.H., & Ernst, E. (2007). Is tai chi an effective adjunct in cancer care? A systematic review of controlled clinical trials. *Supportive Care for Cancer, 15,* 697-601.

Lehrer, P.M., Schoiket, S., Carrington, P., & Woolfolk, R.L. (1980). Psychophysiological and cognitive responses to stressful stimuli in subjects practicing progressive relaxation and clinically standardized meditation. *Behavior Research Therapy, 18,* 293-303.

LeKander, M., Furst, C.J., Rotstein, S., Blomgren, H., & Fredrikson, M. (1996). Social support and immune status during and after chemotherapy for breast cancer. *Acta Oncologica, 35,* 31-37.

Lemay, L.G., Vander, A.J., & Kluger, M.J. (1990). The effects of psychological stress on plasma interleukin-6 activity in rats. *Physiological Behavior, 47,* 957-961.

Lerman, C., Schwartz, M.D., Miller, S.M., Daly, M., Sands, C., and Rimer, B.K. (1996). A randomized trial of breast cancer risk counseling: Interacting effects of counseling, educational level, and coping style. *Health Psychology, 15,* 2, 75-83.

Levin, J.W. (1994). Religion and health: Is there an association, is it valid, and is it causal? *Social Science in Medicine, 38,* 1475-1482.

Levine, E., & Targ, E. (2002). Spiritual correlates of functional well-being in women with breast cancer. *Integrative Cancer Therapies, 1,* 166-174.

Levy, S.M. (1990). Perceived social support and tumor estrogen/progesterone receptor status as predictors of natural killer cell activity in breast cancer patients. *Psychosomatic Medicine, 52,* 73-85.

Levy, S.M., Herberman, R.B., Whiteside, T., Sanzo, K., Lee, J., & Kirkwood, J. (1990). Perceived social support and tumor estrogen/progesterone receptor status as predictors of natural killer cell activity in breast cancer patients. *Psychosomatic Medicine, 52,* 73-85.

Levy, S.M., Herberman, R.B.,Lippman, M., D'Angelo, T., & Lee, J. (1991). Immunological and psychological predictors of disease recurrence in women with early-stage breast cancer. *Behavioral Medicine, 2,* 67-75.

Li, J.X., & Chan, K.M. (2001) Tai Chi: Physiological characteristics and beneficial effects on health. *British Journal of Sports Medicine, 35,* 148-160.

Lunsford, S.L., Simpson, K.S., Chavin, K.D., Hildebrand, L.G., Miles, L.G., Shilling, L.M., Smalls, G.R., & Baliga, P.K. (2006). Racial differences in coping with the need for kidney transplantation and willingness to ask for live organ donation. *American Journal of Kidney Disease, 47,* 324-331.

Maes, M., Song, C., Lin, A., Jongh, R., Gastel, A., Kenis, G., Bosmans, E., Meester, I., Benoy, I., Neels, H., Demedts, P., Janca, A., Scharpe, S., & Smoth, R. (1998). The effects of psychological stress on humans: Increased production of proinflammatory cytokines and a Th1-like response in stress induced anxiety. *Cytokine, 10,* 313.

Maes, M., Smith, R., & Scharpe, S. (1995). The monocyte-T lymphocyte hypothesis of major depression. *Psychoneuroendocrinology, 20,* 111-116

Marucha, P.T., Crespin, T.R., Shelby, R.A., & Andersen, B.L. (2005). Social variables relate to TNF-α levels in cancer patients relate to social variables. *Brain, Behavior, and Immunity, 19,* 521-525.

Mathews, A., Ridgeway, V., Warren, R., & Britton, P. (2002). Predicting worry following a diagnosis of breast cancer. *Psychooncology, 5,* 415-418.

Mayer, J. D., & Salovey, P. (1993). The intelligence of emotional intelligence. *Intelligence, 17*(4), 433-442.

Mayer, J.D. & Salovey, P. (1997). What is emotional intelligence? In P. Salovey & D. Sluyter (Eds.), *Emotional development and emotional intelligence: Implications for educators* (pp. 3-31). New York: Basic Books.

McDonald, J. (2006) Data transformations. Retrieved October 29, 2006 from http://udel.edu/~mcdonald/stattransform.html

McGregor, B.A., Antoni, M.H., Boyers, A., Alferi, S.M., Blomberg, B.B., & Carver, C.S. (2004). Cognitive-behavioral stress management increases benefit finding and immune function among women with early-stage breast cancer. *Journal of Psychosomatic Research, 56,* 1-8

McNair, D.A., Lorr,M., & Droppleman, L.F. (1971). *Profile of Mood States*. San Diego, CA: Educational and Industrial Testing Service.

Meyerowitz, B.E. (1980). Psychosocial correlates of breast cancer and its treatments. *Psychological Bulletin, 87,* 108-31.

Miller, J.M. (1980). Breast cancer statistics. *Mayo Clinic Proceedings, 55,* 585.

Miller, S.M. (1987). Monitoring and blunting: Validation of a questionnaire to assess styles of information seeking under threat. *Journal of Personality and Social Psychology, 52,* 345-353.

Miller, S.M. (1995). Monitoring versus blunting styles of coping influence the information patients want and need about cancer: Implications for cancer screening and management. *Cancer, 76,* 167-177.

Miller, S.M. (1996). Monitoring and blunting of threatening information: Cognitive interference and facilitation on the coping process. In I.G. Sarason, G.R. Pierce, & B.R. Sarason (Eds.), *Cognitive Interference: Theories, Methods, and Findings* (pp. 175-190). Mahwah, NJ: Lawrence Erlbaum.

Miller, S.M., Brody, D.S., and Summerton, J. (1988). Styles of coping with threat: Implications for health. *Journal of Personality and Social Psychology, 54,* 1, 142-148.

Miller, S.M., Combs, C., & Kruus, L. (1993). Turning in and turning out: Confronting the effects of confrontation. In H.W. Krohne (Ed.), *Attention and avoidance: Strategies in coping with aversiveness* (pp. 51-69). Seattle: Hogrefe & Huber.

Miller, S.M., Fang, C.Y., Diefenbach, M.A., & Bales, C. (2001). Tailoring psychosocial interventions to the individual's health information processing style: The influence of monitoring versus blunting in cancer risk and disease. In A. Baum & B. Andersen (Eds.), *Psychosocial Interventions in Cancer.* Washington D.C.: American Psychological Association.

Miller, S.M., Knowles, J.S., Schnoll, R.A., & Buzaglo, J.S. (2002). A cognitive-affective analysis of cancer behavior in the elderly; Are you as healthy as you feel? In Societal Structures and Effective Healthy Behavior in the Elderly, K.W. Schaie, S. Willis, H. Leventhal (Eds.). New York, NY: Springer Publishing, (pp. 65-103).

Miller, S.M., & Mangan, C.E. (1983). The interacting effects of information and coping style in adapting to gynecologic stress: Should the doctor tell all? *Journal of Personality and Social Psychology, 45,* 223-236.

Miller, S.M. & Schnoll, R.A. (2000). When seeing is feeling: A cognitive-emotional approach to coping with health stress. In M. Lewis & J. Haviland (Eds.), *Handbook of emotion.* (pp. 538-557). New York: Plenum Press.

Minami, M., Kuraishi, Y., Yamaguchi, T., Nakai, S., Hirai, Y., & Satoh, M. (1991). Immobilization stress induces interleukin-1 beta mRNA in the rat hypothalamus. *Neuroscience Letters, 123,* 254-256.

Mustian, K.M., Katula, J.A., Gill, D.L., Roscoe, J.A., Lang, D., & Murphy, K. (2004). Tai Chi Chuan, health-related quality of life and self-esteem: a randomized trial with breast cancer survivors. *Supportive Care for Cancer, 12,* 871-876.

Mustian, K.M., Katula, J.A., & Zhao, H. (2006). A pilot study to assess the influence of tai chi chuan on functional capacity among breast cancer survivors. *Journal of Supportive Oncology, 4,* 139-145.

Myers, J.K., & Weissman, M.M. (1980). Use of a self-report symptom scale to detect depression in a community sample. *American Journal of Psychiatry, 137,* 1081-1084.

National Center for Complementary and Alternative Medicine. (NCCAM; 2004). Research Priorities for FY 2005. Retrieved November 10, 2004, from http://nccam.nih.gov/research/priorities/index.htm#5.

Nelson, C.J., Rosenfield, B., Breitbart, W. & Galietta, M. (2002). Spirituality, religion, and depression in the terminally ill. *Psychosomatics, 43,* 213-220.

Nerenz, D.R., Love, R.R., Leventhal, H., & Easterling, D.V. (1986). Psychosocial consequences of cancer chemotherapy for elderly patients. *Health Services Research, 20,* 961-976.

Oken, M.M., Creech, R.H., Tormey, D.C., Horton, J., Davis, T.E., McFadden, E.T., & Carbonne, P.P. (1982). Toxicity and response criteria of the EasternCooperative Oncology Group. *American Journal of Clinical Oncology, 5,* 649-655.

Osowiecki, D. & Compas, B.E. (1998). Psychological adjustment to cancer: control beliefs and coping in adult cancer patients. *Cognitive Therapy and Research, 22,* 483-499.

Post-White, J., Ceronsky, C., Kreitzer, M.J., Nickelson, K., Drew, D., Mackey, W., Koopmeiners, L., et al. (1996). Hope, spirituality, sense of coherence, and quality of life in patients with cancer. *Oncology Nursing Forum, 23,* 1571-1579.

Radloff, L.S. (1977). The CESD Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1,* 385-401.

Raikkonen, K.A. Matthews, J.D. Flory, J.F., Owens, J.F. & Gump, B.B. (1999). Effects of optimism, pessimism, and trait anxiety on ambulatory blood pressure and mood during everyday life, *Journal of Personality and Social Psychology,* 76, 104–113.

Rausch, S.M., Gramling, S., & Auerbach, S. (2006). Effects of a single session of large-group meditation and progressive muscle relaxation training on stress reduction, reactivity, and recovery. *International Journal of Stress Management, 13,* 3, 273-290.

Rawl, S.M., Given, C.W., Champion, V.L., Kozachik, S.L., Kozachik, S.L., Barton, D., Emsley, C.L., & Williams, S.D. (2002). Intervention to improve psychological functioning for newly diagnosed patients with cancer. *Oncology Nursing Forun, 29*(6), 967-975.

Reichlin, S. (1993). Neuroendocrine-immune interactions. *New England Journal of Medicine, 329*, 1246-1253.

Rosberger, Z., Edgar, L., Collet, J-P., & Fournier, M.A. (2002). Patterns of coping in women completing treatment for breast cancer: A randomized controlled trial of Nucare, a brief psychoeducational workshop. *Journal of Psychosocial Oncology, 20*(3), 19-37.

Salovey, P. & Mayer, J.D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality, 9,* 185-211.

Salovey, P., Mayer, J.D., Goldman, S.L., Turvey, C., & Palfai, T.P. (1995). Emotional attention, clarity, and repair: Exploring emotional intelligence using the Trait Meta-Mood Scale. In J.W. Pennebaker (Ed.), *Emoiton, disclosure, and health* (125-154). Washington, DC: American Psychological Association.

Sandlund, E.S., & Norlander, T. (2000). The effects of Tai Chi Chuan relaxation and exercise on stress and well-being. *International Journal of Stress Management, 7,* 139-149.

Schag, C.A., & Heinrich, R.L. (1989). Anxiety in medical situations: adult cancer patients. *Journal of Clinical Psychology, 45,* 20-7.

Scheier, M.F. & Carver, C.S. (1985). Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology, 4,* 219-247.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (2001). Optimism, pessimism, and psychological well-being. In E. C. Chang (Ed.), *Optimism and pessimism: Implications for theory, research, and practice* (pp. 189-216). Washington, DC: American Psychological Association.

Scheier, M.F., Matthews, K.A., Owens, J.F., Schulz, R., Bridges, M.W., Magovern G.J., & Carver, C.S. (1999). Optimism and rehospitalization after coronary artery bypass graft surgery, *Archives of Internal Medicine, 159*, 829–835.

Schmidt, J.E. & Andrykowski, M. (2004). The role of social and dispositional variables associated with emotional processing in adjustment to breast cancer: An internet-based study. *Health Psychology, 23,* 3, 259-266.

Schou, I., Ekeberg, O., Ruland, C.M., Sandvik, L., & Karesen, R. (2004). Pessimism as a predictor of emotional morbidity one year following breast cancer surgery. *Psycho-Oncology, 13,* 309-320.

Schulberg, H.C., Saul, M., McClelland, M., Ganguli, M., Christy, W., & Frank, R. (1985) Assessing depression in primary medical and psychiatric practices. *Archives of General Psychiatry, 42*, 1164-1170.

Segerstrom, S.C. (2001). Optimism, goal conflict, and stressor-related immune change. *Journal Behavioral Medicine, 24*, 441-467.

Segerstrom, S.C. (2005). Optimism and immunity: Do positive thoughts always lead to positive effects? *Brain Behavior and Immunity, 19*, 195-200

Segerstrom, S.C., Taylor, S.E., Kemeny, M.E., & Fahey, J.L. (1998). Optimism is associated with mood, coping, and immune change in response to stress. *Journal of Personality and Social Psychology* , 74, 1646-1655.

Sephton, S.E., Koopman, C., Schaal, M. Thoresen, C., & Spiegel, D. (2001). Spiritual expression and immune status in women with breast cancer. *Breast Journal, 7,* 345-353.

Shapiro, S.L., Lopez, A.M., Schwartz, G.E., Bootzin, R., Figueredo, A.J., Braden, C.J., & Kurker, S.F. (2001). Quality of life and breast cancer: Relationship to psychosocial variables. *Journal of Clinical Psychology, 57,* 4, 501-519.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*(4), 422-445.

Simpson, J.F., Gray, R., Dressler, L.G., Cobau, C.D., Falkson, C.L., Gilchrist, K.W., Pandya, K.J., Page, D.L., & Robert, N.J. (2000). Prognostic value of histologic grade and proliferative activity in axillary node-positive breast cancer: Results from the Eastern Cooperative Oncology Group Companion Study, EST 4189. *Journal of Clinical Oncology, 10,* 2059-2069.

Smith, J.C. (1993). *Understanding stress and coping.* New York: Macmillan.

Smith, J.C. (1990). *Cognitive-behavioral relaxation training: a new system of strategies for treatment and assessment.* New York: Springer Publications.

Snow, H.L. (1893). *Cancer and the Cancer Process.* London: Churchill.

Speca, M., Carlson, L.E., Goodey, E., and Angen, M. (2000). A randomized, wait-list controlled clinical trial: The effect of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients. *Psychosomatic Medicine, 62,* 613-622.

Spencer, S.M., Lehman, J.M., Wynings, C., Arena, P., Carver, C.S., & Antoni, M.H. (1999). Concerns about breast cancer and relations to psychosocial well-being in a multiethnic sample of early-stage patients. *Health Psychology, 18,* 159-168.

Spiegel, D. (1992). Effects of psychosocial support on patients with metastatic breast cancer. *Journal of Psychosocial Oncology, 10,* 113-120.

Spiegel, D., Bloom, J.R., Kraemer, H.C., & Goetheil, E. (1989). Effect of psychosocial treatment on survival of patients with metastatic breast cancer. *Lancet, 2,* 888-891.

Stanton, A.L., & Snider, P.R. (1993). Coping with a breast cancer diagnosis: a prospective study. *Health Psychology, 12,* 1, 16-23.

Stanton, A.L., Danoff-Burg, S., Cameron, C.L., Bishop, M., Collins, C.A., Kirk, S.B., & Sworowski, L.A. (2000). Emotionally expressive coping predicts psychological and physical adjustment to breast cancer. *Journal of Consulting and Clinical Psychology, 68,* 875-882.

Stark, D., Kiely, M., Smith, A. (2002). Anxiety disorders in cancer patients: their nature, associations, and relation to quality of life. *Journal of Clinical Oncology, 20,* 3137-3148.

Strain, J.J. (1990). The evolution of quality of life evaluations in cancer therapy. *Oncology, 4,* 22-26.

Tacon, A.M. (2003). Meditation as a complementary therapy in cancer. *Family and Community Health, 26,* 1, 64-73.

Targ, E.F., & Levine, E.G. (2002). The efficacy of a mind-body-spirit group for women with breast cancer: A randomized controlled trial. *General Hospital Psychiatry, 24,* 238-248.

Taylor, S.E. (1983). Adjustment to threatening events: A theory of cognitive adaptation. *American Psychologist, 38,* 1161-1173.

Taylor, R.E. (2003). Tai Chi as an adjunct to cardiac rehabilitation exercise training. *Journal of Cardiopulmonary Rehabilitation, 23,* 90-96.

Tross, S., Herndon, J., Korzun, A., Kornblith, A.B., Cella, D.F., Holand, J.F., Raich, P., Johnson, A., Kiang, D.T., Perloff, M., Norton, L., Wood, W., & Holland, J.C. (1996). Psychological symptoms and disease-free and overall survival in women with stage II breast cacner. Cancer and Leukemia Group B. *Journal of the National Cancer Institute.*

Tuck, I. (2000). The SPIRIT-10 Intervention. Unpublished Manuscript.

Tuck, I., McCain, N.L., & Elswick, R.K. (2001). Spirituality and psychosocial factors in persons living with HIV. *Journal of Advanced Nursing, 33,* 776-783.

Turner-Cobb, J.M., Sephton, S.E, and Spiegel, D. (2001). Psychosocial effects on immune function and disease progression in cancer: Human studies. In R. Adler, D.L. Felten, & N. Cohen (Eds.), *Psychoneuroimmunology* (3rd ed., Vol. 1)(pp. 565-582). Sand Diego: Academic Press.

Turner-Cobb, J.M., Sephton, S.E., Koopman, C., Blake-Mortimer, J., & Spiegel, D., (2000). Social support and salivary cortisol in women with metastatic breast cancer. *Psychosomatic Medicine, 62,* 337-345.

Uchino, B.N., Cacioppo, J.T., & Kiecolt-Glaser, J.K. (1996). The relationship between social support and physiological processes: a review with emphasis on underlying mechanisms and implications for health. *Psychological Bulletin, 119*, 488–531.

Velikova, G., Wright, E.P., Smith, A.B., Cull, A., Gould, A., Forman, D., Perren, T., Stead, M., Brown, J., and Selby, P.J. (1999). Automated collection of quality-of-life data: A comparison of paper and computer touch-screen questionnaires. *Journal of Clinical Oncology, 17,* 998-1007.

Wang, C., Collet, J.P., & Lau, J. (2004). The effect of Tai Chi on health outcomes in patients with chronic conditions: A systematic review. *Archives of Internal Medicine, 164,* 493-501.

Wang C, Roubenoof R, & Lau J (2005). Effect of tai chi in adults with rheumatoid arthritis. *Rheumatology, 44,* 685-687.

Wanning, T. (1993). Healing and the mind/body arts: Massage, acupuncture, yoga, Tai Chi, and Faldenkrais. *AAOHN, 41,* 349-351.

Watkins, L.O., Weaver, L., & Odegaard, V. (1986). Preparation for cardiac catheterization: Tailoring the content of instruction to coping style. *Heart and Lung, 15,* 382-389.

Weitsman, G.E., Ravid, A., Liberman, U.A., and Koren, R. (2003). Vitamin D enhances caspase-dependent and -independent TNFalpha-induced breast cancer cell death: The role of reactive oxygen species and mitochondria. *International Journal of Cancer, 106,* 178-186.

Weitsman, G.E., Ravid, A., Liberman, U.A., and Koren, R. (2004). The role of p38 MAP kinase in the synergistic cytotoxic action of calcitriol and TNF-alpha in human breast cancer cells. *Journal of Steroidal Biochemical Molecular Biology, 89,* 361-364.

Wolf, S.L., Coogler, C., & Xu, T. (1997). Exploring the basis for Tai Chi Chuan as therapeutic exercise approach. *Archives of Physical Medicine and Rehabilitation, 78,* 886-892.

Xusheng, S., Yugi, X., & Zhu, R. (1990). Detection of ZC rosette-forming lymphocytes in the healthy aged with Taichiquan (88 style) exercise. *Journal of Sports Medicineand Physical Fitness, 30,* 401-405.

Yeh, G.Y., Wood, M.J., & Lorell, B.H. (2004). Effects of tai chi mind-body movement therapy on functional status and exercise capacity in patients with chronic heart failure: a randomized controlled trial. *The American Journal of Medicine, 117,* 541-548.

Yirmiya, R. (1996). Endotoxin produces a depressive-like episode in rats. *Brain Research, 711,* 163-74.

Young, D., Appel, L., Jee, S.H., & Miller, E.R. (1999). The effects of aerobic exercise and T'Chi on blood pressure in older people: Results of a randomized trial. *Journal of the American Geriatric Society, 47,* 277-278.

Zhou, D., Kusnecov, A., Shurin, M., dePaoli, M., & Rabin, B. (1993). Exposure to physical and psychological stressors elevates plasma interleukin-6: Relationship to the activation of hypothalamic-pituitary-adrenal axis. *Endocrinology, 133,* 2523–2530.

Zielinski, C.C., Mueller, C., Tyl, E., Tichatschek, E., Kubista, E., Spona, J. (1990). Impaired production of tumor necrosis factor in breast cancer. *Cancer, 66,* 1944-1948.

Zielinski, C.C., Budinsky, A.C., Wagner, T.M., Wolfram, R.M., Kostler, W.J., Kubista, M., Brodowicz, T., Kubista, E., & Wiltschke, C. (2003). Defect of tumour necrosis factor-alpha (TNF-alpha) production and TNF-alpha-induced ICAM-1-expression in BRCA1 mutations carriers. *Breast Cancer Research and Treatments, 81,* 99-105.

APPENDIX A

MEASURES

MBSS

1. Vividly imagine that you are **afraid** of the dentist and have to get some dental work done. Which of the following would you do? Check **all** of the statements that might apply to you.

___ I would ask the dentist exactly what work was going to be done.

___ I would take a tranquilizer or have a drink before going.

___ I would try to think about pleasant memories.

___ I would want the dentist to tell me when I would feel pain.

___ I would try to sleep.

___ I would watch all the dentist's movements and listen for the sound of the drill.

___ I would watch the flow of water from my mouth to see if it contained blood.

___ I would do mental puzzles in my mind.

2. Vividly imagine that you are being held hostage by a group of armed terrorists in a public building. Which of the following would you do? Check **all** of the statements that might apply to you.

___ I would sit by myself and have as many daydreams and fantasies as I could.

___ I would stay alert and try to keep myself from falling asleep.

___ I would exchange life stories with the other hostages.

___ If there was a radio present, I would stay near it and listen to the bulletins about what the police were doing.

___ I would watch every movement of my captors and keep an eye on their weapons.

___ I would try to sleep as much as possible.

___ I would think about how nice it's going to be when I get home.

___ I would make sure I knew where every possible exit was.

3. Vividly imagine that, due to a large drop in sales, it is rumored that several people in your department at work will be laid off. Your supervisor has turned in an evaluation of your work for the past year. The decision about lay-offs has been made and will be announced in several days. Check **all** of the statements that might apply to you.

___ I would talk to my fellow workers to see if they knew anything about what the supervisor evaluation of me said.

___ I would review the list of duties for my present job and try to figure out if I had fulfilled them all.

___ I would go to the movies to take my mind off things.

___ I would try to remember any arguments or disagreements I might have had that would have resulted in the supervisor having a lower opinion of me.

___ I would push all thoughts of being laid off out of my mind.

___ I would tell my spouse that I'd rather not discuss my chances of being laid off.

___ I would try to think which employees in my department the supervisor might have thought had done the worst job.

___ I would continue doing my work as if nothing special was happening.

4. Vividly imagine that you are on an airplane, thirty minutes from your destination, when the plane unexpectedly goes into a deep dive and then suddenly levels off. After a short time, the pilot announces that nothing is wrong, although the rest of the ride may be rough. You, however, are not convinced that all is well. Check **all** of the statements that might apply to you.

___ I would carefully read the information provided about safety features in the plane and make sure I knew where the emergency exits were.

___ I would make small talk with the passenger beside me.

___ I would watch the end of the movie, even if I had seen it before.

___ I would call for the flight attendant and ask what exactly the problem was.

___ I would order a drink from the flight attendant or take a tranquilizer.

___ I would listen carefully to the engines for unusual noises and would watch the crew to see if their behavior was out of the ordinary.

___ I would talk to the passenger beside me about what might be wrong.

___ I would settle down and read a book or magazine or write a letter.

SAS

Please read each statement and decide whether or not you agree with it. Please indicate how much you AGREE OR DISAGREE with each of the following statements. To do so, simply circle a number from 1 to 5 using the scale shown below.

1 *Strongly Disagree*	2 *Somewhat Disagree*	3 *Neither Agree nor Disagree*	4 *Somewhat Agree*	5 *Strongly Agree*

1. I am worrying too much about things that don't really matter.	1	2	3	4	5
2. I am having difficulty keeping troublesome thoughts out of my mind.	1	2	3	4	5
3. Anxiety-provoking thoughts are running through my mind.	1	2	3	4	5
4. Unimportant thoughts are running through my mind.	1	2	3	4	5
5. I feel worried about things.	1	2	3	4	5
6. I am finding it difficult to control worrisome thoughts.	1	2	3	4	5
7. I have a nervous stomach	1	2	3	4	5
8. I lost my memory and am forgetting things.	1	2	3	4	5
9. I feel sleepy.	1	2	3	4	5
10. My breathing is hurried, shallow, or uneven.	1	2	3	4	5
11. My heart is beating fast, hard, or irregularly.	1	2	3	4	5
12. I lost my appetite.	1	2	3	4	5
13. My shoulders, neck, or back are tense.	1	2	3	4	5
14. My muscles feel tight, tense, or clenched up (furrowed brow, tightened fist, clenched jaws).	1	2	3	4	5
15. I feel fatigued.	1	2	3	4	5
16. I have a backache.	1	2	3	4	5
17. My mouth feels dry.	1	2	3	4	5
18. I am perspiring or feel too warm	1	2	3	4	5
19. I feel the need to go to the restroom unnecessarily	1	2	3	4	5
20. I have a headache.	1	2	3	4	5
21. I feel restless and fidgety.	1	2	3	4	5
22. I feel heavy.	1	2	3	4	5

TMMS

Please read each statement and decide whether or not you agree with it. Please indicate how much you AGREE OR DISAGREE with each of the following statements. To do so, simply circle a number from 0 to 5 using the scale shown below.

		Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
1.	I try to think good thoughts no matter how badly I feel.	1	2	3	4	5
2.	People would be better off if they felt less and thought more.	1	2	3	4	5
3.	I don't think it's worth paying attention to your emotions or moods.	1	2	3	4	5
4.	I don't usually care much about what I'm feeling.	1	2	3	4	5
5.	Sometimes I can't tell what my feelings are.	1	2	3	4	5
6.	I am rarely confused about how I feel.	1	2	3	4	5
7.	Feelings give direction to life.	1	2	3	4	5
8.	Although I am sometimes sad, I have a mostly optimistic outlook.	1	2	3	4	5
9.	When I am upset I realize that the "good things in life" are illusions.	1	2	3	4	5
10.	I believe in acting from the heart.	1	2	3	4	5
11.	I can never tell how I feel.	1	2	3	4	5
12.	The best way for me to handle my feelings is to experience them to the fullest.	1	2	3	4	5
13.	When I become upset I remind myself of all the pleasures in life.	1	2	3	4	5
14.	My belief and opinions always seem to change depending on how I feel.	1	2	3	4	5
15.	I am often aware of my feelings on a matter.	1	2	3	4	5
16.	I am usually confused about how I feel.	1	2	3	4	5
17.	One should never be guided by emotions.	1	2	3	4	5
18.	I never give into my emotions.	1	2	3	4	5
19.	Although I am sometimes happy, I have a mostly pessimistic outlook.	1	2	3	4	5

20.	I feel at ease about my emotions.	1	2	3	4	5
21.	I pay a lot of attention to how I feel.	1	2	3	4	5
22.	I can't make sense out of my feelings.	1	2	3	4	5
23.	I don't pay much attention to my feelings.	1	2	3	4	5
24.	I often think about my feelings.	1	2	3	4	5
25.	I am usually very clear about my feelings.	1	2	3	4	5
26.	No matter how badly I feel, I try to think about pleasant things.	1	2	3	4	5
27.	Feelings are a weakness humans have.	1	2	3	4	5
28.	I usually know my feelings about a matter.	1	2	3	4	5
29.	It is usually a waste of time to think about your emotions.	1	2	3	4	5
30.	I almost always know exactly how I am feeling.	1	2	3	4	5

LOT-R

Please read each statement and decide whether or not you agree with it. Please indicate how much you AGREE OR DISAGREE with each of the following statements. To do so, simply circle a number from 1 to 5 using the scale shown below.

1	**2**	**3**	**4**	**5**
Strongly Disagree	***Somewhat Disagree***	***Neither Agree nor Disagree***	***Somewhat Agree***	***Strongly Agree***

1. In uncertain times I usually accept the best .	1	2	3	4	5
2. Its easy for me to relax.	1	2	3	4	5
3. If something can go wrong for me it will.	1	2	3	4	5
4. I'm always optimistic about my future.	1	2	3	4	5
5 I enjoy my friends a lot.	1	2	3	4	5
6. It's important for me to keep busy.	1	2	3	4	5
7. I hardly ever expect things to go my way.	1	2	3	4	5
8. I don't get upset too easily.	1	2	3	4	5
9. I rarely count on good things happening to me.	1	2	3	4	5
10. Overall, I expect more good things to happen to me than bad.	1	2	3	4	5

POMS

Below is a list of words that describe feelings people have. Please read each one carefully. Then circle ONE number to the right of each which best describes HOW YOU HAVE BEEN FEELING DURING THE LAST WEEK INCLUDING TODAY.

1 *Not at all*	2 *A little*	3 *Moderately*	4 *Quite a bit*	5 *Extremely*
1. Friendly 1 2 3 4 5		23. Unworthy 1 2 3 4 5	44. Unknown 1 2 3 4 5	
2. Tense 1 2 3 4 5		24. Spiteful 1 2 3 4 5	45. Desperate 1 2 3 4 5	
3. Angry 1 2 3 4 5		25. Sympathetic 1 2 3 4 5	46. Sluggish 1 2 3 4 5	
4. Worn out 1 2 3 4 5		26. Uneasy 1 2 3 4 5	47. Rebellious 1 2 3 4 5	
5. Unhappy 1 2 3 4 5		27. Restless 1 2 3 4 5	48. Helpless 1 2 3 4 5	
6. Cear-headed 1 2 3 4 5		28. Unable to concentrate 1 2 3 4 5	49. Weary 1 2 3 4 5	
7.Lively 1 2 3 4 5			50. Bewildered 1 2 3 4 5	
8. Confused 1 2 3 4 5		29. Fatigued 1 2 3 4 5	51. Alert 1 2 3 4 5	
9. Sorry for things done 1 2 3 4 5		30. Helpful 1 2 3 4 5	52. Deceived 1 2 3 4 5	
10. Shaky 1 2 3 4 5		31. Annoyed 1 2 3 4 5	53. Furious 1 2 3 4 5	
11. Listless 1 2 3 4 5		32. Discouraged 1 2 3 4 5	54. Efficient 1 2 3 4 5	
12. Peeved 1 2 3 4 5		33. Resentful 1 2 3 4 5	55. Trusting 1 2 3 4 5	
13. Considerate 1 2 3 4 5		34. Nervous 1 2 3 4 5	56. Full of pep 1 2 3 4 5	
14. Sad 1 2 3 4 5		35. Lonely 1 2 3 4 5	57. Bad-tempered 1 2 3 4 5	
15. Active 1 2 3 4 5		36. Miserable 1 2 3 4 5	58. Worthless 1 2 3 4 5	
16. On edge 1 2 3 4 5		37. Muddled 1 2 3 4 5	59. Forgetful 1 2 3 4 5	
17. Grouchy 1 2 3 4 5		38. Cheerful 1 2 3 4 5	60. Carefree 1 2 3 4 5	
18. Blue 1 2 3 4 5		39. Bitter 1 2 3 4 5	62. Guilty 1 2 3 4 5	
19. Energetic 1 2 3 4 5		40. Exhausted 1 2 3 4 5	63. Vigorous 1 2 3 4 5	
20. (unknown) 1 2 3 4 5		41. Anxious 1 2 3 4 5	64. Uncertain about things 1 2 3 4 5	
21. Hopeless 1 2 3 4 5		42. Ready to fight 1 2 3 4 5	65. Bushed 1 2 3 4 5	
22. Relaxed 1 2 3 4 5		43. Good natured 1 2 3 4 5		

APPENDIX B

TABLE OF MEASURES FROM LARGER STUDY

PNI CONSTRUCT	INDICATORS	MEASURES/INSTRUMENTS
PSYCHOBEHAVIORAL **FACTORS**	Psychobehavioral Concepts A. Precursors • Perceived stress associated with living with breast cancer B. Process Variables • Coping patterns • Social support • Inner strength • Spirituality	IES and FACT-B subscale EWB WAYS SPS ISQ SWBS
	Adaptational Outcomes **C. *Psychosocial Functioning*** • depressive symptoms • benefit finding	CES-D BFS FACT-G FACT-B subscale BCS
	D. *Quality of Life* • general health-related • breast cancer-specific	
NEUROENDOCRINE MEDIATION		Urinary cortisol, beta-endorphin, leu-enkephalin
IMMUNOLOGICAL OUTCOMES		NK cell and LAK cell cytotoxicity Cytokines: • Type 1= IFNγ TNFα IL-1β, -2, & -12 • Type 2 = IL-4, -6, & -10
ADAPTATIONAL **OUTCOMES**	Psychosocial Functioning and Quality of Life **E. *Physical Health*** • Symptom Distress • Health Status • Fatigue	As above SES Clinical Assessment Tool PFS, 6-minute walk
DISEASE STATUS	Recurrence (2 years)	F/U Physical Exams & laboratory/radiologic diagnostics

Vita

Sarah Michelle Rausch was born on April 8, 1977, in Mankato, MN. She graduated from Mankato West High School in 1995. She received her Bachelor of Arts *Summa Cum Laude* in Psychology from The University of North Carolina at Charlotte in 2001. She received a Master of Arts in Clinical Psychology from Virginia Commonwealth University in 2004.